

MEDICAL ENTOMOLOGY STUDIES - XVI.

A REVIEW OF THE SPECIES OF SUBGENUS *VERRALLINA*,
GENUS *AEDES*, FROM SRI LANKA AND A REVISED
DESCRIPTION OF THE SUBGENUS
(DIPTERA: CULICIDAE)¹

By

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ABSTRACT

All information on the subgenus *Verrallina* Theobald of the genus *Aedes* Meigen from Sri Lanka is reviewed. Identification keys for females, males, pupae and fourth stage larvae from Sri Lanka are presented. Ten species, *Ae. butleri* Theobald, *Ae. indicus* (Theobald), *Ae. lankaensis* Stone and Knight, *Ae. lugubris* Barraud (new country record), *Ae. petroelephantus* Wijesundara, *Ae. pseudomediofasciatus* (Theobald), *Ae. seculatus* Menon, *Ae. spermathecus* Wijesundara, *Ae. srilankensis* Reinert and *Ae. yerburyi* Edwards, are currently known from Sri Lanka. Each species treatment includes synonymy, descriptions and illustrations of adults, pupae and fourth stage larvae, type-data, distribution, discussion, bionomics and pertinent literature. Lectotypes for *Ae. lugubris* and *Ae. pseudomediofasciatus* are designated. A revised treatment of the subgenus *Verrallina* is given and includes descriptions of all stages, distribution, discussion, medical importance and bionomics.

INTRODUCTION

The first report of a species of the subgenus *Verrallina* Theobald from Sri Lanka was for *Ae. pseudomediofasciatus*, a new species described by Theobald (1910: 489). James reported *Ae. butleri* from the island in 1914 (p. 262) and this was followed by the description of 2 new species, *Ae. ceylonicus* (= *Ae. lankaensis* Stone and Knight) and *Ae. yerburyi*, by Edwards 1917: 221, 222). No additional species of the subgenus were reported from

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Sri Lanka until 1950 (p. 139) when Menon described *Ae. seculatus* and Wijesundara (1951: 175) reported the presence of *Ae. indicus* (Theobald), *Ae. spermathecus* Wijesundara, *Ae. petroelephantus* Wijesundara and *Ae. carteri* Wijesundara (= *Ae. seculatus*). Twenty-six years later, Reinert (1977: 366) described the new species, *Ae. srilankensis*. The latest addition to the fauna is *Ae. lugubris* which is now reported here. Reinert (1974b), in his presentation of a new interpretation of the subgenus *Verrallina*, discussed 7 species. Other publications concerning *Verrallina* from Sri Lanka treated only 1-3 previously reported species or gave lists of species.

The present study provides a revised treatment of the subgenus *Verrallina* and includes descriptions (male, female, pupa, larva and egg), distribution, discussion, medical importance and bionomics. The *Verrallina* fauna of Sri Lanka is covered in detail so that for each species all known stages are described, pertinent structures are illustrated, and sections are included on type-data, distribution, discussion, and bionomics. Keys to the females, males, pupae and fourth stage larvae are given. Appendices include records of the branching of the setae on the pupae (Tables 1-5) and fourth stage larvae (Tables 6-9). Pertinent literature is listed in the literature cited section.

Brinck et al. (1971: IV) gave an excellent discussion of Sri Lanka and included: morphology and geology, climate, terrestrial habitats, inland aquatic habitats, and land use. Their presentation included maps of Sri Lanka which illustrated: relief, geology, annual rainfall, generalized ecosystems, provincial subdivisions, population density, percentage cultivated land, and percentage forests. Numerous photographs of Sri Lankan ecosystems and 18 pertinent references to the country are included.

The abbreviations used in the literature cited section conform to the "Serial Sources for the BIOSIS Data Base," BioSciences Information Service, Philadelphia, 1982. In the synonymy sections, an asterisk following the abbreviations used (♀ = female, ♂ = male, P = pupa, L = larva and E = egg) indicates that at least some portion of that sex or stage is figured. In the distribution sections, the abbreviations used are the same as in the synonymy sections, but with the following 2 additions: p = pupal exuvium and l = larval exuvium. In the pupal descriptions and tables the number of branches of abdominal seta 1-I was counted on the basal third of the seta; therefore, only primary branches are recorded. The scale for the illustrations is in millimeters. Distribution records are indicated as follows: countries are in capital letters, provinces are in italics, and place names are with the first letter capitalized. The number of specimens examined from each province follows the place names of the province in the distribution section. The spelling of provincial and locality names was taken from the Official Standard Names Gazetteer prepared by the Office of Geography, U. S. Department of the Interior for Sri Lanka (= Ceylon) (1960). Locality names which did not appear in the gazetteer were spelled according to the labels on the specimens.

Information in the distribution and bionomics sections was taken from the collection data sheets and specimen labels of the specimens that I examined and from the published literature. In the type-data sections information within brackets [] is additional to that included on the original specimen labels.

Nomenclature and chaetotaxy used for the female, female genitalia, male, male genitalia, pupa and larva follow Harbach and Knight [1980, 1981 (1982)]. Indices used in the female genitalia descriptions follow Reinert (1974a).

Reinert: *Aedes (Verrallina)* of Sri Lanka

GENUS *Aedes* MEIGEN

SUBGENUS *VERRALLINA* THEOBALD

Type-species: *Aedes butleri* Theobald

Aedes of Theobald 1901: 224 (*in part*); Brunetti 1907: 367; Brunetti 1920: 141 (*in part*); Senior-White 1923: 52 (*in part*).

Verrallina Theobald 1903a: 295; of Theobald 1910: 494 (*in part*); Blanchard 1905: 417 (*in part*); Leicester 1908: 196; Brunetti 1912: 491.

Aedes (?) of Theobald 1905: 35.

Skusea of Blanchard 1905: 417 (*in part*); Theobald 1910: 488 (*in part*).

Neomacleaya Theobald 1907: 238; of Theobald 1910: 243; Brunetti 1912: 458.

Aioretomyia Leicester 1908: 185; of Brunetti 1914: 55.

Aedes (Aedes) of Edwards 1913: 229; Edwards 1917: 221, 1922a: 272, 1922b: 468, 1932: 174 (*in part*); Barraud 1928: 363, 1934: 277; Laffoon 1946: 228; King and Hoogstraal 1947: 113; Wijesundara 1951: 173; Knight and Hull 1953: 471; Stone et al. 1959: 204 (*in part*); Delfinado et al. 1962 (1963): 440; Stone 1963: 131, 1967: 210; Knight and Stone 1977: 70 (*in part*).

Aedes (Verrallina) of Belkin 1962: 412; Stone 1963: 131, 1970: 152; Steffan 1966: 213; Huang 1968: 1; Stone and Delfinado 1973: 310; Reinert 1974b: 3; Knight and Stone 1977: 167; Knight 1978: 167; Tanaka et al. 1979: 436.

Aedes (Neomacleaya) of Delfinado 1967: 1, 1968: 1; Stone 1970: 153; Klein 1973: 1; Stone and Delfinado 1973: 302.

The following treatment of *Verrallina* includes all species in the subgenus.

FEMALE. Head. Antenna dark brown, 0.91-1.42 length of proboscis, pedicel brown with a few short fine setae and usually a few small scales mesally, flagellomere 1 with basal area pale and with several small scales; clypeus bare; maxillary palpus dark brown scaled, 4 segmented, 0.11-0.21 length of proboscis; proboscis dark brown scaled, 0.84-1.55 length of femur I; eyes contiguous (Section A) or separated in front (Section B and *Ae. mccormicki* Belkin); ocular setae dark and well developed; scales on head broad and decumbent except for a few narrow curved pale scales along coronal suture (most species of Series III of Section A) and a few semi-erect forked scales near ocular line in Section B, a few narrow scales on ocular line; occiput with several to numerous erect forked scales, decumbent scales broad and/or narrow. **Thorax.** Scutal integument usually dark; scutum covered with narrow curved dark scales, some species also with narrow curved pale scales forming small patches usually on following areas: anterior promontory, anterior and lateral scutal fossal, supraalar and occasionally on margins of prescutellar area; prescutellar area bare, a few species with a narrow median cephalic stripe of scales; dark setae on the following areas: 2-10 anterior promontory, several to numerous acrostichal (anterior and posterior), several to numerous dorsocentral (anterior and posterior), scutal fossal [2-9 anterior, 2-8 lateral, 0-3 median and 0-5 (usually 1-2) posterior], numerous supraalar, 4-8 posterior medial scutal, 1 parascutellar; scutellum with a patch of narrow curved scales on each lobe, several long and short setae on both lateral and median lobes; pleural integument brown, usually dark; antepronota widely separated, broad scales present or absent, 7-28 short and long setae; postpronotum with narrow curved scales dorsally (a few species with these scales apparently absent) in Section A, or scales absent in Section B, 3-10 posterior setae, some species

also with a few short fine setae, proepisternum with a patch of broad white scales and 4-21 setae on upper area, lower area bare except for *Ae. adustus* Laffoon, *Ae. andamanensis* Edwards, *Ae. margarsen* Dyar and Shannon and *Ae. sohni* Reinert, which have a small patch of short fine setae on median dorsal area; paratergite bare except *Ae. indicus* which has a few narrow pale scales; subspiracular area and mesomeron bare; postspiracular area with or without scales, 2-12 setae; mesokatepisternum with an upper and a lower patch of broad scales, 1-7 upper and 4-19 lower setae, some species also with a few short fine setae on anterior, dorsal and ventral areas; prealar area usually without scales, 4-22 setae; mesepimeron with a patch of broad white scales near center, 5-33 setae dorsad of scale patch, Section A with a few (2, 3) to numerous fine golden setae caudad of scale patch, setae in some species restricted to lower posterior margin of scale patch while others have numerous fine setae along entire posterior margin of scale patch and extend to near ventral margin of sclerite; metameron usually bare (short fine setae and small pale scales present in *Ae. gibbosus* Delfinado and members of the Andamanensis Group). *Legs.* Coxae I-III with several setae and a patch of pale scales, I also usually with brown scales; trochanters I-III with a few short setae and small scales; femora I and II with anterior surfaces brown scaled, II occasionally with a pale scaled ventral stripe, I with posterior surface brown scaled with a pale scaled dorsal longitudinal stripe, II with posterior surface with a pale scaled ventral longitudinal stripe, III with anterior and posterior surfaces pale scaled except for an anterodorsal and posterodorsal longitudinal brown scaled stripe; tibiae I-III brown scaled, I and II occasionally with a longitudinal pale scaled stripe on posterior surfaces; tarsi I-III brown scaled; posttarsi I-III with unguis variable, III with unguis simple in Section A and toothed in Section B. *Wing.* Dorsal and ventral veins with brown scales; alula with scales on margin, scales narrow to moderately broad; upper calypter with several setae on margin; 1-3 remigial setae. *Halter.* Pedicel pale; capitellum covered with pale and/or dark scales. *Abdomen.* Tergal scaling variable, all dark scaled or with pale scaled patches and bands, usually with a laterobasal pale scaled patch, tergum I always with a laterobasal patch of broad pale scales; sternal scaling variable, from completely pale to dark scaled, usually with pale scaled broad basal bands and apical areas dark scaled; terga and sterna with numerous short setae, mostly along posterior margins. *Genitalia.* Tergum VIII with numerous broad scales covering apical 0.50-0.84, nearly entire surface covered in species of Section A, basal 0.1-0.7 retracted into segment VII, moderately to heavily pigmented, wide, base usually slightly concave, apex gently convex or slightly concave, numerous short and moderately long setae scattered over apical 0.24-0.88, basolateral seta present or absent, some species with a small bulla in this location, covered with minute spicules, VIII-Te index 0.35-0.80, VIII-Te/IX-Te index 1.05-6.84; sternum VIII with numerous broad scales covering much of apical 0.78-0.96 (nearly entire surface covered in species of Section A), moderately to heavily pigmented, wide, base concave mesally, apex with a shallow to moderately deep median indentation and with a small lobe on each side of midline, setae on lobe usually thin (Section A) or stout (Section B), numerous short and moderately long setae scattered over most of surface, covered with minute spicules, apical intersegmental fold unpigmented, VIII-S index 0.47-0.80; tergum IX moderately to heavily pigmented, wide, usually short and ribbon-like, setae absent (several setae present in *Ae. gibbosus* and *Ae. yusafi* Barraud), covered with minute spicules, IX-Te index 0.12-0.83; insula small, unpigmented, with 2-7 small tuberculi (usually each with a minute

Reinert: *Aedes (Verrallina)* of Sri Lanka

spicule), covered with minute spicules, or insula absent (Section B) and replaced by median apical portion of lower vaginal sclerite; lower vaginal lip moderately to heavily pigmented, narrow, with or without spicules, with or without a small caudally projected heavily pigmented median projection, lower vaginal sclerite very lightly to heavily pigmented, variable in shape and number, with or without spicules; upper vaginal lip moderately to heavily pigmented, variable in shape and development, may have median posterior area developed into a vertical shield (Section A, Series III) or a horizontal shield (Section B), with or without spicules, upper vaginal sclerite moderately to heavily pigmented, variable in shape and development, very large, often nearly covering wall of vagina; spermathecal eminence heavily pigmented, shallow to deep in depth, simple to complex, with or without spermathecal eminence spicules, without (Section A) or with (Section B) a heavily pigmented spine-lined pouch; postgenital lobe short to moderately long, narrow to moderately broad, apex rounded or with a small to very deep median indentation, 5-29 setae on each side of midline, 11-57 total setae, covered with small spicules, dorsal PGL index 0.47-1.78, ventral PGL index 0.43-2.13; proctiger with minute spicules; cercus triangular in shape, short to moderately long, usually broad at base, apex acute, covered with minute to small spicules, dorsal surface with a number of short and moderately long setae scattered over most of surface, a few long setae at apex, ventral surface with a number of short to moderately long setae along outer margin and becoming more numerous distally, none to numerous broad scales on dorsal surface, cercus index 1.76-4.27, cercus/dorsal PGL index 2.42-5.30; 3 spermathecal capsules, 1 large, 1 medium and 1 small, heavily pigmented, elliptical or ovoid, with a narrow or broad neck, a few to several small spermathecal capsule pores near orifice, base of accessory gland duct unpigmented to moderately pigmented.

MALE. Usually similar to female in general habitus but with the following differences. *Head.* Antenna plumose, 0.76-1.27 length of proboscis; maxillary palpus short, 0.09-0.18 length of proboscis; proboscis 0.93-1.56 length of femur I. *Thorax.* Most setal groups usually with fewer setae. *Legs.* Posttarsi variable, III with unguis simple in Section A (except *Ae. prioekaensis* Brug which has one of the unguis with a small tooth) and unguis toothed in Section B. *Abdomen.* Terga with lateral setae rather short; tergum VIII wide with a number of long caudally directed setae. *Genitalia.* Tergum IX moderately to heavily pigmented, mesal area narrow, setae absent; gonocoxite short, broad, heavily pigmented, mesal surface membranous with minute spicules, dorsal, lateral and ventral surfaces with short to long setae, many species with dorsoapical and/or ventroapical lobes or projections, some species with spiniform setae subapically on sternomesal area, few to numerous scales on lateral and ventral areas; gonostylus subapically attached to gonocoxite in most species, short to moderately long, moderately to heavily pigmented, variable in shape but usually with basal portion somewhat expanded and with a few setae, apical portion narrow and curved, gonostylar claw absent; basal mesal lobe variable in development, consists of a plate situated on membranous basal mesal area of gonocoxite and is strongly fused along sternal margin to tergomesal margin of sclerotized ventral surface of gonocoxite, plate connected with its mate by a narrow band covered with spicules and located ventrad of apical portion of prosophallus, with several to numerous short to moderately long thin setae, some groups also with lobes, projections or spiniform setae; proctiger with paraproct variously developed, many species with paraproct modified into short or long, heavily pigmented, free arms, other species with paraproct developed into broad contiguous heavily pigmented plates,

sternobasal area produced into a small lobe which extends ventrad and articulates at a point on the dorsal surface of the basal piece near base of opisthophallus, base of proctiger fused with tergum X, cercal setae absent; tergum X moderately to heavily pigmented, fused with tergum IX; phallosome complex, opisthophallus--composed of a lightly to heavily pigmented tergal transverse bridge between basal pieces, located dorsal of phallus and prosophallus and ventrad of proctiger, phallus--composed of a pair of heavily pigmented, narrowly separated, caudally produced aedeagal sclerites which are fused together by a narrow basal bridge, base extends laterally and is fused to basal portion of prosophallus, apex of phallus formed into a tergal penis filament which extends cephalad, prosophallus--composed of a pair of moderately to heavily pigmented arms or plates (prosophallic sclerites) with bases moderately to widely separated, base attached to paramere, located laterad and slightly ventrad of phallus, paramere--heavily pigmented, short and small (Section A) or very long and moderately broad (Section B), basal piece--moderately to heavily pigmented, short to long, outer surface broadly attached to tergoapodeme of gonocoxite; sternum IX heavily pigmented throughout, large, broad, several short setae in a patch near median caudal area, most species of Section B and several species of Series III of Section A also with a few broad scales.

PUPA. Chaetotaxy and other features are summarized as follows.
Cephalothorax. Setae 1-3-CT approximately equally developed; 1-CT single to 5 branched; 2-CT single to 4 branched; 3, 6-CT single to 3 branched; 6-CT almost always single; 4-CT single to 9 branched; 5-CT with 2-12 branches; 7-CT with 2-9 branches, moderately long to long; 8-CT with 2-11 branches; 9-CT single to 6 branched. *Metanotum.* Seta 10-CT with 2-13 branches; 11-CT single; 12-CT with 2-8 branches. *Trumpet.* Moderately to heavily pigmented; hair-like spicules on inner surface of meatus; index 3.0-5.8. *Abdomen.* Setae 0-II, VII, VIII single; 0-III, IV, VI single or 2 branched; 0-V single to 3 branched; 1-I dendritic, well developed with 10-38 branches on basal third; 1-II with 3-37 branches; 1-III with 2-14 branches; 1-IV, V single to 10 branched; 1-VI single to 8 branched; 1-VII single to 6 branched; 2-I single or 2 branched; 2-II-VII stout in many species; 2-II-V, VII single; 2-VI single or 2 branched; 3-I single to 8 branched; 3-II single or 2 branched; 3-III single; 3-IV with 2-10 branches; 3-V single to 7 branched; 3-VI single to 6 branched; 3-VII with 2-9 branches; 4-I with 3-12 branches; 4-II with 2-11 branches; 4-III single to 8 branched; 4-IV single to 5 branched; 4-V with 2-11 branches; 4-VI single to 12 branched; 4-VII single to 7 branched; 4-VIII single to 5 branched; 5-I-III with 2-9 branches; 5-IV, VII single to 6 branched; 5-VI single to 4 branched; 6-I, II single to 3 branched; 6-III, V single to 5 branched; 6-IV, VI single to 5 branched; 6-VII single to 8 branched; 7-I, IV single to 6 branched; 7-II single to 7 branched; 7-III single to 8 branched; 7-V single to 11 branched; 7-VI single to 4 branched; 7-VII single to 3 branched; 8-III, VII single to 6 branched; 8-II, VI single to 5 branched; 8-V single to 7 branched; 9-I single to 3 branched; 9-II-VI single; 9-VII single to 4 branched, weakly developed; 9-VIII single to 6 branched; 10-I single; 10-III single to 10 branched; 10-IV single to 7 branched; 10-V, VII single to 4 branched; 10-VI single to 3 branched; 11-I single or 2 branched, usually present; 11-III single or 2 branched; 11-VI single to 3 branched; 11-VII single to 4 branched; 14-III-VI single; 14-VII-VIII single or 2 branched. *Paddle.* Ovoid; minute serrations on basal area of outer margin; minute spicules on apical portions of outer and inner margins; midrib lightly to moderately pigmented and nearly reaches or reaches apex; seta 1-P usually single, occasionally 2 branched; index 1.14-1.70.

Reinert: *Aedes (Verrallina)* of Sri Lanka

LARVA. Chaetotaxy and other features summarized as follows. *Head*. Lightly to heavily pigmented; patch of small spicules over compound eye area in some species (*Ae. cyrtolabis* Edwards, *Ae. indicus*, *Ae. leicesteri* Edwards, *Ae. torosus* Delfinado, *Ae. uncus* (Theobald) and *Ae. yerburyi*); setae 0, 1, 3, 18-C single; 4-C with 2-12 branches; 5, 9-C single to 9 branched; 6-C single to 7 branched; 7-C with 2-17 branches; 8, 13-C single to 6 branched; 10, 11-C with 2-8 branches; 12-C single to 10 branched; 14-C single to 4 branched; 15-C single to 11 branched; 20-C single or 2 branched; 1-C well developed, long and thickened; 4-C small and weakly developed; 5-7-C long, well developed and barbed; 4-C slightly cephalad of 6-C and mesad of 5, 6-C; 6-C laterad and well cephalad of 5-C; 7-C cephalad and well laterad of 6-C; 5, 6-C with one branch longer than others in many species of Series I and III of Section A; dorsomentum heavily pigmented, with 17-45 teeth; lateral palatal brush with mesal filaments pectinate apically; ventromedian cervical sclerite moderately to heavily pigmented, moderately large. *Antenna*. Short to moderately long; usually moderately pigmented; scattered spicules over most of length, usually more numerous on basal area and longer on outer area near middle; seta 1-A single to 9 (usually 2-6) branched, short to moderately long, attached near middle of antennal length, branches more or less flattened; 2-A long, with a subapical constriction; 3-A short, 0.20-0.36 length of 2-A; 4-A moderately long, 0.37-0.74 length of 2-A; 5-A with basal area flattened, pigmented and with a dorsal spine, apical portion unpigmented; 6-A peglike, short, 0.22-0.39 length of 2-A. *Thorax*. Seta 0-P with 4-26 branches; 1, 7-P single to 3 branched; 2, 3-P single to 5 branched; 4-P single to 9 branched; 5-P single; 6, 8, 10-P single to 2 branched; 9-P single to 7 branched; 11-P with 2-7 branches; 12-P single to 6 branched; 14-P single to 4 branched; 1-M with 2-8 branches; 2-M single to 7 branched; 3-M single to 4 branched; 4-M with 3-13 branches; 5, 12-M single or 2 branched; 6-M with 3-9 branches; 7, 10-M single; 8-M with 4-11 branches; 9-M with 5-12 branches; 11-M single to 3 branched; 13-M with 7-40 branches; 14-M with 3-20 branches; 1-T single to 8 branched; 2-T single to 10 branched; 3-T with 3-21 branches; 4-T single to 11 branched; 5, 10-T single or 2 branched; 6-T single to 6 branched; 7-T with 4-12 branches; 8-T with 7-27 branches; 9-T with 2-4 branches; 11-T single to 4 branched; 12-T single to 3 branched; 13-T with 4-23 branches. *Abdomen*. Seta 0-II-VIII single; 1-I single to 5 branched; 1-II single to 6 branched; 1-III, VII with 2-13 branches; 1-IV with 3-15 branches; 1-V with 3-13 branches; 1-VI with 2-11 branches; 1-VIII with 2-10 branches; 2-I-VII single; 2-VIII single to 5 branched; 3-I with 4-13 branches; 3-II with 3-16 branches; 3-III with 2-13 branches; 3-IV, VII with 2-12 branches; 3-V with 2-8 branches; 3-VI with 2-10 branches; 3-VIII with 4-11 branches; 4-I with 7-27 branches; 4-II with 4-18 branches; 4-III with 2-8 branches; 4-IV with 2-5 branches; 4-V with 4-15 branches; 4-VI with 2-11 branches; 4-VII with 2-7 branches; 4-VIII single to 4 branched; 5-I single to 9 branched; 5-II with 2-8 branches; 5-III single to 6 branched; 5-IV single to 4 branched; 5-V single to 5 branched; 5-VI single to 7 branched; 5-VII with 2-10 branches; 5-VIII with 5-15 branches; 6-I single to 3 branched; 6-II single to 6 branched; 6-III single; 6-IV, V single or 2 branched; 6-VII with 4-18 branches; 7-I single to 3 branched; 7-II with 2-12 branches; 7-III with 5-15 branches; 7-IV with 2-17 branches; 7-V with 4-17 branches; 7-VI with 2-13 branches; 7-VII single to 10 branched; 8-II single to 4 branched; 8-III-V single or 2 branched; 8-VI with 2-9 branches; 8-VII with 2-14 branches; 9-I with 2-7 branches; 9-II single to 4 branched; 9-III, V, VI single or 2 branched; 9-IV single; 9-VII single to 5 branched; 10-I with 2-8 branches; 10-II, III, V, VII single to 6 branched;

10-IV single to 8 branched; 10-VI single to 5 branched; 11-I, III-V, VII single to 5 branched; 11-II single to 6 branched; 11-VI single to 7 branched; 12-II, VII single to 6 branched; 12-III with 2-6 branches; 12-IV with 2-5 branches; 12-V single to 4 branched; 12-VII single to 10 branched; 13-I single to 3 branched; 13-II with 4-24 branches; 13-III, IV with 2-11 branches; 13-V with 2-13 branches; 13-VI with 9-62 branches; 13-VII with 4-18 branches; 14-II, IV, V, VIII single; 14-III, VI single or 2 branched; 14-VII single to 3 branched; VIII with comb composed of 7-17 scales arranged in a more or less curved irregular row (*Ae. cuccioi* Belkin with scales in 2 rows, one row very short), scales long with a stout median apical spine and small denticles on latero-basal areas or moderately long with uniformly developed denticles on lateral and apical areas; 1-X single to 3 branched, moderately long, attached near middle of posterior area of paddle; 2-X, single to 11 branched (usually multiple branched, very seldom single or 2 branched), moderately long (long in *Ae. cuccioi*); 3-X single, very long; ventral brush with 8-18 setae on grid and 1-4 precratal shorter setae (usually with 10 setae on grid and 2, 3 precratal setae), all multiple branched; saddle moderately to heavily pigmented, incompletely rings segment X, acus absent; 4 anal papillae, usually moderately long (short in *Ae. butleri* and very long in *Ae. cuccioi*, *Ae. hamistylus* Laffoon and *Ae. robertsi* Laffoon). *Siphon*. Lightly to heavily pigmented; moderately long; index 1.58-5.00; acus well developed; pecten on basal 0.49-0.65 (on basal 0.67-0.83 in *Ae. cuccioi*, *Ae. hamistylus*, *Ae. robertsi*, *Ae. similis* (Theobald) and *Ae. trispinatus* King and Hoogstraal), composed of 6-17 spines (*Ae. johnsoni* Laffoon with 14-20 spines but when 17 or more present the basal 2, 3 spines are much reduced in size), distal 1-5 spines longer and wider spaced than remainder, each spine long, slender and with 1-3 small stout ventral denticles near base, distal 1-4 spines occasionally without denticles; seta 1-S with 2-10 branches, short, base attached on basal 0.63-0.83 of siphon distad of last pecten spine (attached within pecten in *Ae. cuccioi*, *Ae. similis* and *Ae. trispinatus*); 2, 6, 7, 9-S single, 6-S occasionally 2 branched; 8-S single to 8 branched, usually multiple branched.

EGG. Seven species of *Verrallina* have the egg stage known. Huang (1968: 21, 30, 33, 48) illustrated and gave measurements for the following 4 species: *Ae. carmenti* Edwards, *Ae. funereus* (Theobald), *Ae. lineatus* (Taylor) and *Ae. parasimilis* King and Hoogstraal. Moriya et al. (1973: 52, 54) published a description and scanning electron microphotograph of the egg of *Ae. nobukonis* Yamada but did not give the egg measurements, Reinert (1974b: 41, Fig. 51) described and illustrated the egg of *Ae. dux* Dyar and Shannon, and Matsuo et al. (1974: 440, 443) gave a description and scanning electron microphotograph of the egg of *Ae. butleri*. Egg measurements (in microns) of known eggs are: *Ae. butleri* (630-720 x 150-180), *Ae. carmenti* (845 x 140), *Ae. dux* (637-730 x 154-179), *Ae. funereus* (806 x 268), *Ae. lineatus* (756 x 206) and *Ae. parasimilis* (1040 x 200).

DISTRIBUTION. The subgenus *Verrallina* has primarily an Oriental distribution, but encompasses an area from the Maritime Territory of the Soviet Union through Hainan Island of China, Vietnam, Thailand, Burma, India, Sri Lanka, Indonesia, northern Australia, New Hebrides, Solomon Islands, Caroline Islands and southern Japan.

In Sri Lanka, species of *Verrallina* have been collected from all provinces except the Eastern. From reported collections, *Ae. pseudomediofasciatus* has the widest distribution on the island and is known from 7 provinces. Five species (*Ae. lankaensis*, *Ae. lugubris*, *Ae. petroelephantus*, *Ae. seculatus* and *Ae. spermathecus*) have been found in only one province. The other

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species are each recorded from 2 or 3 provinces. Four species (*Ae. lankaensis*, *Ae. petroelephantus*, *Ae. spermathecus* and *Ae. srilankensis*) are apparently endemic to Sri Lanka. *Aedes butleri* occupies a wide range outside Sri Lanka and has been reported from Brunei, India, Indonesia, Malaysia, Papua New Guinea, Philippine Islands, Singapore, Thailand and Vietnam. *Aedes lugubris* occurs in Burma, India, Malaysia and Thailand in addition to Sri Lanka. Three species, *Ae. pseudomediofasciatus*, *Ae. seculatus* and *Ae. yerburyi*, have been collected in India and *Ae. indicus* has been found in India and Pakistan.

DISCUSSION. The above description of the subgenus is revised and modified from that of Reinert (1974b: 3) and is based on examining specimens of 92 species and the published descriptions of the remaining 2 species.

Verrallina is characterized and separated from the other subgenera of *Aedes* by the following: in the adults by the combination of (1) head with decumbent scales of vertex all broad or with only a double row of narrow curved scales on coronal suture, (2) antennal pedicel with several short fine setae and usually a few small broad scales mesally, (3) dorsocentral (anterior and posterior) and acrostichal (anterior and posterior) setae present, several to numerous, species in Section B usually with only a few posterior acrostichals, (4) scutum and scutellum with only narrow curved scales, (5) remigial setae present, (6) subspiracular area and paratergite bare (*Ae. indicus* with a few pale scales on paratergite), (7) mesepimeron without anterior lower setae, however, all species except the 13 species of Section B, have a few to numerous fine setae caudad of scale patch, (8) upper proepisternum with 4-21 setae, and (9) male maxillary palpus short (0.09-0.18 length of proboscis); in the female genitalia by the combination of (1) heavily pigmented spermathecal eminence, (2) presence of lower vaginal sclerite, (3) tergum VIII and sternum VIII with numerous broad scales covering nearly entire surface (except Section B), and (4) presence of 3 heavily pigmented spermathecal capsules, each of a different size; in the male genitalia by the combination of (1) complex development of phallosome which consists of several component parts (see below), (2) gonostylus without gonostylar claw, (3) sternum IX heavily pigmented throughout, setae present, (4) tergum IX without setae, and (5) development of proctiger; in the pupae by the combination of (1) setae 1-3-CT approximately equally developed, (2) 6, 9-VII both weakly developed, (3) 9-VIII single to 6 branched, (4) 1-P single, occasionally double, and (5) paddle without fringe of hair-like spicules; and in the larvae by the combination of (1) arrangement and development of head setae 4-7-C, (2) antenna with spicules and seta 2-A with a subapical constriction, (3) pecten with 6-20 (usually 12-16) spines, distal 1-5 spines wider spaced than remainder, (4) acus present on siphon, absent on saddle, and (5) ventral brush usually with 10 setae on grid and 2, 3 precatal shorter ones, all multiple branched.

The subgenus was divided into sections and series by Reinert (1974b: 11). Definitions of these follow.

SECTION A: *Adults*. Posttarsi III with ungues simple¹; eyes contiguous in front², vertex without erect or semi-erect scales, occiput with erect scales; mesepimeron with a few to numerous fine setae

¹Male of *Ae. prioekanensis* with a small tooth on one ungue.

²Eyes of *Ae. mccormicki* separated in front.

caudad of scale patch; postpronotum with narrow curved scales on upper area¹; anteppronotum without scales except for a very few species. *Female genitalia*. Insula small, unpigmented, with 2-7 small tuberculi; sternum VIII with numerous thin setae on a pair of median apical lobes; upper vaginal lip with or without median posterior area produced into a vertical shield caudad of spermathecal eminence; lower vaginal sclerite very lightly to heavily pigmented, shape and number of plates variable but always positioned on floor of vagina and not attached to lower vaginal lip, with or without spicules; spermathecal eminence shallow to deep, simple to complex, with or without spermathecal eminence spicules, without a pouch. *Male genitalia*. Phallosome with prosophallus and phallus approximately equal in length, paramere short, basal piece short to moderately long. *Pupa*. Trumpet usually with basal area not expanded, but expanded apically or with uniform width throughout; lateralia with or without poorly to moderately developed cuticular ocular facets of the compound eye. *Larva*. Antennal seta 1-A with 3-9 (usually 4-6) branches, head seta 7-C with 5-17 (usually 7-14) branches; thoracic seta 4-P with 3-6 (usually 4-6) branches².

Series I. *Female genitalia*. Upper vaginal lip with median posterior area narrow and not produced into a shield; lower vaginal sclerite with a pair of very lightly pigmented plates connected by a small apical band, without spicules, all species with uniform shape; spermathecal eminence shallow, simple, composed of a pair of common-shaped plates, without spermathecal eminence spicules. *Male genitalia*. Gonocoxite without dorsoapical or ventroapical lobes on fleshy projections, with one or more subapical spiniform setae on sternomesal area; basal mesal lobe composed of a small broad plate with a number of short to moderately long thin setae; prosophallus with apical 0.5-0.6 produced into several lightly pigmented flattened contiguous leaf-like structures; gonostylus attached to apex of gonocoxite (*Ae. quadrispinatus* King and Hoogstraal and *Ae. variabilis* Huang attached slightly subapically). *Pupa*. Trumpet with a more or less uniform width throughout (a few species with apical portion expanded); bases of setae 2-IV-VI (in most species) more cephalad than bases of setae 4-IV-VI; seta 9-VIII usually 3-6 branched. *Larva*. Comb scales with uniformly developed denticles on lateral and apical areas; seta 2-X usually single to 3 branched³, usually with one branch

¹A few species of Series I did not have scales on the postpronotum but these may have been rubbed off in the specimens examined.

²Seta 4-P rarely 2 branched in *Ae. pseudomediofasciatus*.

³Seta 2-X with 3, 4 branches in *Ae. sentanius* King and Hoogstraal, 6, 7 branches in *Ae. lineatus* and 8 branches in *Ae. variabilis*.

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longer than others¹.

Series II. *Female genitalia*. Upper vaginal lip with median posterior area moderately broad and not developed into a vertical shield; lower vaginal sclerite with a pair of lightly to moderately pigmented plates, usually ovoid, with spicules; spermathecal eminence shallow, simple, with or without poorly developed small spermathecal eminence spicules. *Male genitalia*. Gonocoxite occasionally without but usually with dorsoapical or ventroapical lobes or fleshy projections, without subapical spiniform setae² on sternomesal area; basal mesal lobe composed of a small plate with several short to moderately long thin setae and one or more stout spiniform setae or lobes; prosophallus with apical 0.4-0.5 produced into several lightly pigmented flattened contiguous leaf-like structures or a single short broad plate; gonostylus attached to apex of gonocoxite.

Pupa. Trumpet as for Series I; bases of setae 2, 4-IV-VI as for Series I; seta 9-VIII usually single³. *Larva*. Comb scales with a stout median apical spine⁴ and with smaller denticles on laterobasal areas; seta 2-X with 4-11 (usually 6 or more) branches, all approximately equal in length.

Series III. *Female genitalia*. Upper vaginal lip with median posterior area developed into a large vertical shield caudad of spermathecal eminence; lower vaginal sclerite heavily pigmented, shape and number of plates variable, usually with spicules; spermathecal eminence deep, complex, with numerous well developed spermathecal eminence spicules. *Male genitalia*. Gonocoxite with one or more well developed dorsoapical and/or ventroapical lobes or fleshy projections, without subapical spiniform setae on sternomesal area; basal mesal lobe, composed of a large plate with several to numerous short to moderately long thin setae and with 2 or more stout spiniform setae and/or one or more large lobes or projections; prosophallus composed of a moderately long to long narrow heavily pigmented sclerite; gonostylus attached subapically to gonocoxite. *Pupa*. Trumpet with apical portion expanded; bases of setae 2-IV-VI (in most species) more caudad than bases of setae 4-IV-VI; seta 9-VIII usually single or 2 branched. *Larva*. As for Series II.

¹Branches of seta 2-X approximately equal in length in *Ae. foliformis* King and Hoogstraal, *Ae. lineatus* and *Ae. variabilis*.

²*Aedes butleri* and *Ae. incertus* Edwards with spiniform setae but also with apical projections.

³*Aedes lugubris* with seta 9-VIII with 3-6 branches.

⁴*Aedes butleri* with 1, 2 slightly longer and stouter median apical denticles.

SECTION B. *Adults*. Posttarsi III with ungues toothed; eyes separated in front; vertex with a few semi-erect scales, occiput with erect scales; mesepimeron without fine setae caudad or below scale patch; postpronotum without scales; anteppronotum with broad scales. *Female genitalia*. Insula absent but replaced by a U-shaped median apical projection of lower vaginal sclerite, without tuberculi; sternum VIII with numerous very stout setae on a pair of median apical lobes; upper vaginal lip with median posterior area produced into a large horizontal shield extending over or around spermathecal eminence; lower vaginal sclerite heavily pigmented, formed into a pair of ribbon-like plates around floor of vagina, attached to lower vaginal lip throughout length, fused at apex and developed into a median, U-shaped projection, plates without spicules; spermathecal eminence shallow, simple, without spermathecal eminence spicules, with a heavily pigmented cephalad spine-lined pouch. *Male genitalia*. Phallosome with prosophallus very long, phallus short and 0.5 or less length of prosophallus, paramere very long, basal piece very long. *Pupa*. Trumpet with basal 0.4 somewhat expanded; lateralia with well developed cuticular ocular facets of the compound eye; bases of setae 2-IV-VI more cephalad than bases of setae 4-IV-VI. *Larva*¹. Antennal seta 1-A single or 2 branched; head seta 7-C with 2-4 branches; thoracic seta 4-P single to 3 branched.

Of the 93 species recognized in the subgenus *Verrallina*, Reinert (1974b: 16) listed 81 species in Section A (Series I with 25 species, Series II with 10 species, and Series III with 46 species) and 12 species in Section B. Since 1974 one additional new species, *srilankensis*, was added to Section B (Reinert 1977: 366). All stages of the species of *Verrallina* can be separated to either Section A or B; however, they can be divided into series easily by using the female and male genitalia. Species in Series II of Section A appear to occupy an intermediate position between those in Series I and III and possess morphological features of the other 2 series.

Adults of *Verrallina* are similar in habitus to those of the subgenus *Aedes* Meigen especially *Ae. cinereus* Meigen; however, they differ significantly in the development of both the male and female genitalia. Species of the subgenus *Aedes* differ from the adults of *Verrallina* by the combination of the following: anteppronotum and paratergite with narrow scales (only *Ae. indicus* of *Verrallina* has scales on the paratergite); vertex of head with a broad median area covered with narrow curved scales; male with a greater number of setae in antennal whorls; abdominal terga of male with numerous long curved setae on lateral margins; and mesepimeron without fine setae caudad or ventrad of the scale patch.

The short maxillary palpus of the male is similar to those of the following subgenera of *Aedes*: *Aedes*, *Belkinius* Reinert, *Bothaella* Reinert, *Canhraedes* Edwards, *Christophersiomyia* Barraud, *Huaedes* Huang, *Leptosomatomyia* Theobald, *Nothoskusea* Dumbleton, *Paraedes* Edwards, *Rhinoskusea* Edwards, and most species of *Geoskusea* Edwards. Both males and females of *Verrallina* can be separated from those of these and other subgenera of *Aedes* by a com-

¹*Aedes consonensis* Reinert is somewhat aberrant for Section B in that one larva had seta 1-A with 3 branches on one side, 7-C with 7 branches on one side and 4-P with 4 branches on one side.

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bination of the above mentioned characters.

The importance of the female genitalia for separating the species of the subgenus with first recognized by Barraud (1928: 363). The female genitalia of *Verrallina* are easily distinguished from all other subgenera of *Aedes* by the features listed above. Other characters that are unusual and can be used to separate species of *Verrallina* from many other *Aedes* are: tergum IX wide, usually ribbon-like, usually without setae except *Ae. gibbosus* and *Ae. yusafi* (some species, such as *Ae. clavatus* Barraud, *Ae. quadrifolium* Brug and *Ae. vallistris* Barraud occasionally with a single short seta on one side); tergum VIII usually very wide; cerci triangular in shape; insula small, unpigmented with 2-7 tuberculi, each usually with a minute spicule, or insula absent (Section B) and replaced by median apical portion of lower vaginal sclerite; and upper vaginal sclerite very large and in many species covering most of vaginal roof. Each species of *Verrallina* except members of Section A, Series I, which have very uniformly developed genitalia, possesses distinguishing features of the female genitalia which separates it from other species of the subgenus. The shape of tergum IX is, however, useful in separating a number of species in Series I.

Male genitalia of *Verrallina* are very distinct from other subgenera of *Aedes* especially in the complex development of the phallosome which is divided into the following components: opithophallus, phallus (with its tergal penis filament), prosophallus, paramere and basal piece. Several of the structures are fused at the joints and have no definite sutures (Reinert 1973b, 1974b). The complex arrangement and partial fusion of the integral parts of the phallosome of *Verrallina* appear to be similar to forms found in the dixine genera *Nothodixa* Edwards and *Paradixa* Tonnoir (these 2 genera discussed and described by Belkin 1968). Other structures and developments of the genitalia of this subgenus which distinguish many of the species from a number of subgenera of *Aedes* are as follows: tergum IX without setae; proctiger with paraprocts highly modified into short or long free arms or broad contiguous plates, cercal setae absent; basal mesal lobe modified into a setose lobe which is strongly fused along its sternal margin with the tergomesal margin of the ventral surface of the gonocoxite, many species (Section A, Series II and III and Section B) with stout spiniform setae and/or projections; sternum IX heavily pigmented throughout, setae present (usually numerous), most species of Section B and several species of Series III of Section A with broad scales; gonostylus without a gonostylar claw; and gonocoxite with dorso-apical and/or ventroapical lobes or projections. The male genitalia of each species are very distinct; however, the genitalia of species in Series I of Section A appear to have undergone less differentiation and are more uniform than the other series and section.

Pupae of *Verrallina* can be distinguished from those of most other subgenera of *Aedes* by using the above combination of characters. Species within the subgenus are very similar in chaetotaxy and many species are difficult to separate from each other. However, features can usually be found to identify specimens from a specific geographical area because only a few species are usually found in any one area.

Placement and development of setae in the larvae of *Verrallina* are fairly uniform within species groups; however, most species possess distinguishing features in this stage. Larvae of *Verrallina* are similar to those of *Aedimorphus* Theobald but can be separated from them by the positions of head setae 4-6-C and the position of the pecten as given by Reinert (1973a, 1974b). The subapical constriction of antennal seta 2-A is consistent for all members of

the subgenus *Verrallina*, but a number of species of subgenera *Aedimorphus*, *Edwardsaedes* Belkin, *Finlaya* Theobald, *Neomelaniconion* Newstead and *Ochlerotatus* Lynch Arribalzaga also possess this feature. The occurrence of precratal setae of the ventral brush is also shared by the species in some other subgenera (i. e., *Aedes*, *Aedimorphus*, *Edwardsaedes*, *Mucidus* Theobald, *Neomelaniconion* and *Ochlerotatus*) which inhabit temporary ground pools.

MEDICAL IMPORTANCE. Within the subgenus *Verrallina* the following 46 species have been reported as feeding on humans: *Ae. adustus*, *Ae. andamanensis*, *Ae. atriisimilis* Tanaka and Mizusawa, *Ae. atrius* Barraud, *Ae. butleri*, *Ae. campylostylus* Laffoon, *Ae. carmentis*, *Ae. cautus* Barraud, *Ae. clavatus*, *Ae. cretatus* Delfinado, *Ae. cyrtolabis*, *Ae. dux*, *Ae. fragilis* (Leicester), *Ae. funereus*, *Ae. gibbosus*, *Ae. hamistylus*, *Ae. incertus*, *Ae. indecorabilis* (Leicester), *Ae. indicus*, *Ae. iriomotensis* Tanaka and Mizusawa, *Ae. johorensis* Reinert, *Ae. killertonis* Huang, *Ae. lankensis*, *Ae. lineatus*, *Ae. lugubris*, *Ae. macrodixa* (Dyar and Shannon) group, *Ae. milnensis* King and Hoogstraal, *Ae. multifolium* King and Hoogstraal, *Ae. nobukonis*, *Ae. notabilis* Delfinado, *Ae. pahangi* Delfinado, *Ae. panayensis* Ludlow, *Ae. parasimilis*, *Ae. phnomus* Klein, *Ae. pseudomediofasciatus*, *Ae. quadrifolium*, *Ae. reesi* King and Hoogstraal, *Ae. sabahensis* Reinert, *Ae. sentanius*, *Ae. similis*, *Ae. stungus* Klein, *Ae. uncus*, *Ae. vallistris*, *Ae. vanapus* Huang, *Ae. varietas* (Leicester), and *Ae. yusafi* (one or more species cited by: Barraud 1928: 367, 373, 1934: 296; Laffoon 1946: 238, 243, 244; King and Hoogstraal 1947: 118, 120, 130; Wijesundara 1951: 174; Wharton et al. 1964: 68; Bonne-Wepster 1954a: 245, 1954b: 95; Ann. Rep., Inst. Med. Res. for 1956 and 1965, Fed. Malaya and Malaysia, 1957: 108, 1968: 23; Macdonald 1957: 23; Colless 1959: 260; Reid 1961: 46; Belkin 1962: 418, 419; Peters (in Peters and Christian) 1963: 55; Steffan 1966: 213, 214; Delfinado 1967: 13, 32, 33, 1968: 33, 38; Huang 1968: 17, 21, 31, 32, 36, 38, 41, 48, 49, 55, 59, 63; Aslamkan and Salman 1969: 194; Harinasuta et al. 1970: 35; Klein 1973: 2-6, 10, 11; Rahman et al. 1973: 239; Ann. Prog. Rep., Univ. Calif. Internat. Center Med. Res., 1973: 3, 1979: 25; Tanaka and Mizusawa 1973: 632, 635; Reinert 1974b: 20, 22, 28, 39, 44-46, 52, 60, 67, 71-73, 84, 90, 92, 101; Harinasuta et al. 1974: 111; Tanaka et al. 1975: 224; Key et al. 1977: 451; Miyagi and Toma 1979: 16; Tanaka et al. 1979: 442, 443, 445). This list contains approximately one-half of the known species of the subgenus. In addition to the records of *Verrallina* species feeding on humans, many species also attack domestic animals.

Few investigations of *Verrallina* species for pathogens have been conducted even though a large number of species feed on man and at times voraciously attack humans in large numbers. The difficulty encountered by investigators in separating adults of many species by habitus characters may partially account for the low number of published accounts of attempts to isolate pathogens from species of the subgenus. In Sri Lanka, Carter (1948: 314) found that an endemic focus of filariasis, 0.2% of dissected female *Ae. pseudomediofasciatus* were infected with *Brugia malayi*, 0.9% were positive from a slightly endemic area, and 11.1% were positive from an area considered to be non-endemic. Rozeboom and Cabrera (1964: 24) in the Philippines, found 5 *Ae. andamanensis* group and one *Ae. macrodixa* group females were negative, while one of 4 *Ae. nigrotarsis* was positive for a filaria parasite. *Aedes butleri* in Malaysia were negative for filaria parasites (Ann. Rep., Inst. Med. Res. for 1957, Fed. Malaya, 1958: 134), but later one of 132 females dissected was positive for *Dirofilaria* species (Ann. Rep., Inst. Med. Res. for 1963, Fed. Malaya, 1968: 48). In Thailand, Harinasuta et al. (1970: 35) found

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Ae. butleri negative for *Brugia malayi* parasites.

A virus (MM-2021) was isolated from *Ae. butleri* in Malaysia (Ann. Rep., Inst. Med. Res. for 1957, Fed. Malaya, 1958: 101, 103). Macdonald (1957: 4) listed *Ae. butleri* as a possible vector of dengue and Japanese B encephalitis on epidemiological grounds. Reid (1961: 52) also suggested that *Ae. butleri* group was a possible vector of dengue or Japanese B encephalitis. A Group A virus was isolated from *Ae. butleri* from Malaysia by the University of California International Center for Medical Research (Ann. Prog. Rep., 1974: 38). *Aedes carmentis*, *Ae. funereus* and *Ae. similis* from Queensland, Australia, were found to be negative for virus isolations by Doherty et al. (1963: 22). Klein (1973: 11) reported that 1,667 specimens of *Ae. valleris* from Cambodia were inoculated into suckling mice and no viruses were isolated. Kay et al. (1977: 451) reported that newly emerged wild caught *Ae. funereus* females from Australia, which avidly bit humans mainly during the day but were also active throughout the night, showed evidence of arbovirus multiplication in laboratory tests. They found that *Ae. funereus* could support several arboviruses of known (Kunjin, Murray Valley encephalitis, Ross River) or suspected (Sepik) medical importance as well as others (Corriparta, D'Aguilar, Getah, Koongol, Warrego, Wongorr).

BIONOMICS. Most immature stages prefer temporary, unmoving water in shaded pools located in forested areas. Some species, notably *Ae. butleri*, prefer brackish water in coastal mangrove swamps.

Females of a number of species readily bite humans (see Medical Importance section) and domestic animals usually during the day and in shaded forested areas. Adults of many species have been collected in light traps.

The bionomics of *Verrallina* species have been summarized by Steffan (1966), Delfinado (1967, 1968), Huang (1968), Klein (1973) and Reinert (1974b). Bionomics of other species reported since 1974 are given by Reinert (1978), Tanaka et al. (1979) and Miyagi and Toma (1979). The bionomics of many species, however, are unknown or only imperfectly known.

KEYS TO SPECIES OF *AEDES (VERRALLINA)* FROM SRI LANKAFEMALES¹

1. Anteprenotum with broad scales; abdominal terga II-VII dark scaled. *srilankensis*
Anteprenotum without scales; abdominal terga II-VII with pale scaled areas. 2
- 2(1). Postspiracular area with pale scales; abdominal terga III, IV with median transverse pale scaled bands. *indicus*
Postspiracular area without scales; abdominal terga III, IV without pale scaled bands. 3
- 3(2). Abdominal tergum II with a narrow pale scaled basal band. . . *lugubris*
Abdominal tergum II without a pale scaled band. 4

¹Female of *Ae. seculatus* is unknown.

- 4(3). Postpronotum with 2-4 short fine pale setae ventrad of posterior setae; mesokatepisternum with 3-7 short fine pale setae anterior to upper scale patch. *yerburyi*
 Postpronotum without short fine pale setae ventrad of posterior setae; mesokatepisternum without short fine pale setae anterior to upper scale patch. 5
- 5(4). Abdominal terga V, VI with laterobasal pale scaled patches not extended onto dorsum. 6
 Abdominal terga V, VI with laterobasal pale scaled patches extended well onto dorsum. 7
- 6(5). Abdominal terga with small laterobasal pale scaled patches; postgenital lobe with a small median indentation and with 29-36 setae. *butleri*
 Abdominal terga with large laterobasal pale scaled patches; postgenital lobe with a deep median indentation and with 2-4 setae. *spermathecus*
- 7(5). Lower vaginal sclerite a single large plate covering most of lower vaginal wall (Fig. 6). *pseudomediofasciatus*
 Lower vaginal sclerite consists of 2 plates on basal 0.5 of lower vaginal wall. 8
- 8(7). Lower vaginal sclerites projected from mesal area; base of cercus moderately broad (Fig. 5). *petroelephantus*
 Lower vaginal sclerites projected from lateral areas; base of cercus broad (Fig. 3). *lankaensis*

MALES¹

1. Tergum IX with a pair of long caudally produced lobes (Fig. 17). *srilankensis*
 Tergum IX without lobes. 2
- 2(1). Paraproct bifid (Fig. 15). *pseudomediofasciatus*
 Paraproct not bifid. 3
- 3(2). Basal mesal lobe with 8 moderately long, stout, spiniform setae, caudal 2 on a short lobe (Fig. 16). *seculatus*
 Basal mesal lobe otherwise, or if stout spiniform setae present then less than 5. 4
- 4(3). Sternum IX with a pair of moderately long caudal lobes; gonostylus short, cone-shaped, length less than width of gonocoxite at point of attachment (Fig. 13). *lankaensis*
 Sternum IX without caudal lobes; gonostylus not cone-shaped, length noticeably longer than width of gonocoxite at point of attachment. 5

¹Males are unknown for *Ae. petroelephantus* and *Ae. spermathecus*.

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- 5(4). Gonostylus a long, narrow arm with 1-3 (usually 2) very short setae; gonocoxite with apex extended into a long, broad, flattened lobe (Fig. 12). *indicus*
 Gonostylus not a long arm, with 3-21 (usually 5 or more) long well developed setae; gonocoxite with apex not developed into a long, broad, flattened lobe. 6
- 6(5). Basal mesal lobe with a long (longer than length of gonocoxite), narrow, free arm extended from base; gonostylus with 3-6 setae (Fig. 18).
yerburyi
 Basal mesal lobe without a long arm extended from base; gonostylus with 13 or more setae. 7
- 7(6). Gonocoxite with a long ventrobasal lobe terminating in apical thumb- and finger-shaped structures; gonostylus with a short subapical thumb-like structure (Fig. 14). *lugubris*
 Gonocoxite without a ventrobasal lobe terminating in apical thumb- and finger-shaped structures; gonostylus with a long subapical lobe bearing 3-5 short apical setae (Fig. 11). *butleri*

PUPAE¹

1. Trumpet index 2.53-3.45; seta 1-II with 4-7 branches. *indicus*
 Trumpet index greater than 3.45; seta 1-II with 8-37 branches². 2
- 2(1). Seta 1-V single or 2 branched; seta 1-VI single or 2 branched.
pseudomediofasciatus
 Seta 1-V with 3-6 branches; seta 1-VI with 3-7 branches. 3
- 3(2). Seta 3-VII with 2, 3 branches; seta 9-VIII with 3-6 branches. *lugubris*
 Seta 3-VII with 4-9 branches; seta 9-VIII single or 2 branches. 4
- 4(3). Trumpet index 3.51-4.13; seta 11-VI usually 2, 3 branched; seta 5-IV usually 3-6 branched. *yerburyi*
 Trumpet index 4.13-5.60; seta 11-VI single; seta 5-IV single or 2 branched. *butleri*

¹Pupae are unknown for *Ae. lankaensis*, *Ae. petroelephantus*, *Ae. seculatus*, *Ae. spermathecus* and *Ae. srilankensis*.

²Seta 1-II occasionally with 7 branches in *Ae. yerburyi*, but this species is distinguished from *Ae. indicus* by seta 1-III which has 5-13 branches while the later species has only 3, 4 branches.

FOURTH STAGE LARVAE¹

1. Seta 4-VIII with 2, 3 branches; seta 5-C with 5-9 (usually 6-8) branches. *pseudomediofasciatus*
 Seta 4-VIII single; seta 5-C with 2-4 (usually 3) branches. 2
- 2(1). Head without a patch of spicules over compound eye; seta 8-P single, comb scales without a single long stout median spine. . . *butleri*
 Head with a patch of spicules over compound eye; seta 8-P with 2 branches; comb scales with a single long stout median spine. . . 3
- 3(2). Head with a cuticular pattern; seta 1-A with 4-6 branches; seta 6-I with 2 branches. *yerburyi*
 Head without a cuticular pattern; seta 1-A with 2, 3 branches; seta 6-I with 3, 4 branches. *indicus*

Aedes (Verrallina) butleri THEOBALD
 (Figs. 1, 11, 19, 24, 28-30)

- Aedes butleri* Theobald 1901: 226, 230 (♀, key); Giles 1902: 480, 481 (♀, key).
Verrallina butleri of Theobald 1903a: 285, 295 (♀*); Leicester 1908: 196 (♀, ♂).
- Skusea diurna* Theobald 1903b: 259 (♀); of Theobald 1907: 547 (♀*, key), 1910: 488, 490 (key); Edwards 1913: 229 (synonymy).
- Verrallina butleri* of Blanchard 1905: 417 (♀); Theobald 1910: 494 (key); Brunetti 1912: 491.
- Aedes ? butleri* of Theobald 1905: 35.
- Aedes butleri* of Brunetti 1907: 367, 1912: 489, 1920: 143; Moulton 1914: 47; Edwards 1922a: 264 (key); Senior-White 1923: 53; Colless 1957: 109, 1959: 260; Wharton et al. 1964: 68; Yin-Coggrave and Pong 1964: 360; Stojanovich and Scott 1965: 11, 21 (♀*, L*, keys), 1966: 47, 111 (♀, L*, keys); Harinasuta et al. 1970: 35.
- Stegomyia hatiensis* Carter 1910: 275 (♀*); Edwards 1913: 229 (synonymy).
- Aedes (Aedes) butleri* of Edwards 1913: 229 (♀), 1924: 351, 1928: 53, 1932: 175; Barraud 1934: 296 (♀* only, key); Carter 1950: 89; Wijesundara 1951: 175, 178 (♀ only, key); Iyengar and Menon 1956: 790 (♀*, ♂*).
- Aedes butleri* of James 1914: 262; Mattingly 1956: 794 (lectotype selection).
- Aedes (Aedes) butleri* of Edwards 1922b: 468; Brug and Haga 1923: 639; Barraud 1928: 373 (♀*, key); Causey 1937: 414; Brug and Bonne-Wepster 1947: 185; Knight and Hull 1951: 215 (keys), 1953: 476; Chow et al. 1954: 117; Horsfall 1955: 529; Macdonald 1957: 23; Stone et al. 1959: 204; Delfinado et al. 1962 (1963): 440; Thurman 1963: 52.
- Aedes (Skusea) umbrosus* Brug 1924: 437 (♀, ♂*).
- Aedes (Aedes) umbrosus* of Edwards 1924: 351, 1928: 53; Edwards and Given 1928: 345 (L*).

¹Larvae are unknown for *Ae. lankaensis*, *Ae. lugubris*, *Ae. petroelephantus*, *Ae. seculatus*, *Ae. spermathecus* and *Ae. srilankensis*.

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Aedes (Aedes) umbrosus of Laffoon 1946: 229-231, 234, 241, 243 (♀*, ♂*, L*, keys, tentative synonymy); Brug and Bonne-Wepster 1947: 185; Bick 1949: 2; Iyengar and Menon 1956: 790 (♀*); Knight and Hull 1953: 477 (synonymy).

Aedes (Aedes) carteri Wijesundara 1951: 176, 178 (♀* only, key); Reinert 1974b: 84 (synonymy ♀ only).

Aedes umbrosus of Mattingly 1956: 794.

Aedes (Verrallina) butleri of Belkin 1962: 412; Stone 1963: 131; Army Mosquito Project 1965: 29, 63 (keys); Stone et al. 1966: 50, 58 (keys); Huang 1968: 12, 13, 16 (♀, ♂, P, L, keys); Basio 1971: 32, 129 (♂*); Stone and Delfinado 1973: 310; Reinert 1974b: 17, 22 (♀*, ♂*, P*, L*), 1976: 206 (L); Hochman and Reinert 1974: 8 (L); Matsuo et al. 1974: 440, 443 (E*); Knight and Stone 1977: 167; Knight 1978: 34.

FEMALE (Fig. 30). *Head.* Antenna dark brown, 1.01-1.11 length of proboscis, pedicel dark brown with a few small dark scales and short fine setae mesally, flagellomere 1 with basal 0.25 pale and with several small dark scales near middle; clypeus dark brown; maxillary palpus blackish-brown scaled, 0.17-0.21 length of proboscis; proboscis blackish-brown scaled, 1.17-1.24 length of femur I; eyes contiguous; vertex covered with broad blackish-brown decumbent scales and a double row of broad white decumbent scales on midline extending anteriorly nearly to ocular line (some specimens with only a few white scales); interocular space with 6-8 narrow curved white scales (some specimens with these scales pale brown); ocular setae blackish-brown and well developed; postgena blackish-brown scaled with a narrow stripe of white scales extending from area in front of antepnotum to ocular suture; occiput with a patch of short erect forked scales, mesal ones dark and lateral ones paler. *Thorax.* Scutal integument dark brown; scutum covered with narrow curved reddish-black scales except for a small patch of narrow curved white scales on anterior promontory area; prescutellar area bare; dark reddish-black setae on following areas: 2-4 anterior promontory, numerous acrostichal (anterior and posterior), numerous dorsocentral (anterior and posterior), scutal fossal (4-6 anterior, 4, 5 lateral and 2 posterior), several prescutellar, numerous antealar, 6 posterior medial scutal; scutellum with a patch of narrow curved reddish-black scales on each lobe, 8-10 setae on lateral lobe and 9-11 setae on median lobe; pleural integument dark brown; antepnotum without scales, 11-17 long and short dark setae: postpronotum with a dorsal patch of narrow curved reddish-black scales, 5-8 dark posterior setae; proepisternum with a patch of broad white scales and 9-12 dark setae on upper area; postspiracular area without scales, 3-8 dark setae; meso-katepisternum with an upper and a lower patch of broad white scales, several anterior scales of upper patch show a brownish tinge, 4, 5 upper and 14-16 dark posterior setae, a few (3-6) short fine pale setae cephalad of upper scale patch near subspiracular area; prealar area with 9-12 dark setae; mesepimeron with a median patch of broad white scales, 13-15 setae (several short and fine) dorsad of scale patch, several short fine golden setae on areas caudad and ventrad of scale patch but not extending over lower area; other pleural areas bare. *Legs.* Coxae I-III with several dark setae, I with broad brown scales and a small dorsal patch of white scales on anterior surface, II, III with a patch of broad white scales on anterior surface; trochanters I-III with a few short setae and a few broad pale brown scales; femora I, II with anterior surface dark brown scaled, I with a broad posterodorsal longitudinal stripe of pale brownish scales, II with a broad posteroventral longitudinal stripe of pale brownish

scales, remainder of posterior surfaces of I, II dark brown scaled, III dark brown scaled with an anteroventral broad longitudinal stripe of creamy colored scales from base to near apex, posterior surface with a ventral broad longitudinal pale brownish stripe; tibiae I-III and tarsi I-III blackish-brown scaled; posttarsi I-III (Fig. 28) with 2 ungues, I, II with ungues equal in size, each with a tooth, III with ungues equal in size, both simple. *Wing*. Dorsal and ventral veins blackish-brown scaled; alula with several moderately broad dark brown scales on margin; upper calypter with several pale brown setae on margin; one remigial seta. *Halter*. Pedicel pale; capitellum dark brown scaled. *Abdomen*. Terga blackish-brown scaled, I with a small laterobasal patch of white scales, II-VII each with a small lateral white scaled patch, extreme lateral portion of patch basal; sterna brown scaled with a laterobasal white scaled spot, V, VI also with a few pale scales on mesal areas. *Genitalia* (Fig. 1). Tergum VIII with numerous broad scales covering apical 0.59-0.77, basal 0.10-0.35 retracted into segment VII, moderately to heavily pigmented, wide, base and apex both nearly straight, lateral margins slightly concave, several moderately long stout setae apically and a few short ones scattered over apical 0.39-0.57, basolateral seta usually present, VIII-Te index 0.54-0.66, VIII-Te/IX-Te index 3.11-3.83, length 0.23-0.27 mm, width 0.37-0.47 mm; sternum VIII with numerous broad scales covering apical 0.78-0.90 except for a small median area, moderately to heavily pigmented, wide, base concave, apex with a moderately deep (0.10-0.14 of length) median indentation and with a small lobe on each side of midline, numerous short and moderately long setae scattered over apical 0.75-0.87, setae somewhat stouter on apex and submedian lobes, more numerous on the latter, apical intersegmental fold unpigmented, VIII-S index 0.62-0.69, length 0.23-0.26 mm, width 0.34-0.39 mm; tergum IX moderately pigmented, wide, short and band-like, base with a short broad median indentation, apex slightly concave, setae absent, IX-Te index 0.32-0.40, length 0.07-0.09 mm, width 0.20-0.23 mm; insula unpigmented, short, 4, 5 small tuberculi, each with a minute spicule; lower vaginal lip moderately pigmented, covered with minute spicules, with a small caudally projected heavily pigmented median arm, lower vaginal sclerites composed of a basal pair of oblong moderately pigmented structures covered with small spicules on dorsal surface and situated on an elevated portion of the membrane extended over area between vaginal lip, and a small subapical heavily pigmented, narrow to moderately broad, posterolateral area produced into a small lobe, posterior and posterolateral lobe covered with minute spicules, upper vaginal sclerite very large, well developed, base attached to basal half of lateral area of upper vaginal lip and with a heavily pigmented projection on posterobasal area, sclerite bifurcate with anterior branch wide, moderately pigmented and attached to cephalic portion of spermathecal eminence, posterior branch wide, heavily pigmented with a caudally produced, heavily pigmented, mesally curved arm connected with its mate by a small membranous strip which forms a crown around the spermathecal eminence; spermathecal eminence heavily pigmented, shallow in depth, composed of a pair of comma-shaped lateral structures connected caudally and produced into a fleshy very lightly pigmented cephalic projection, moderately long spermathecal eminence spicules on lateral and cephalic areas; postgenital lobe short, wide, apex broad, flat or with a small (0.0-0.1 of dorsal length) median indentation, 14-19 setae on each side of midline, 29-36 total setae, dorsal PGL index 0.82-1.10, ventral PGL index 1.11-1.23, ventral length 0.07-0.09 mm; cercus with a number (12 or more) of broad scales on dorsal surface, triangular, moderately long and broad at base, apex acute, dorsal surface with

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a number of long and moderately long setae and a few short ones on apical 0.84-0.94, ventral surface with a few short setae along outer area, cercus index 2.38-2.72, cercus/dorsal PGL index 2.91-3.43, cercus length 0.20-0.24 mm; 3 spermathecal capsules, 1 large, 1 medium and 1 small, heavily pigmented, spherical, each with a short pigmented neck, base of accessory gland duct moderately pigmented.

MALE. Essentially as in the female but with the following differences.

Head. Antenna plumose, 0.97-1.09 length of proboscis; maxillary palpus 0.11-0.14 length of proboscis; proboscis 1.09-1.11 length of femur I; vertex with only 2, 3 broad white scales on midline. **Thorax.** Scutellum with 6-8 setae on lateral lobe and 8-10 setae on median lobe; 9-11 anteprenotal setae; 4 postprenotal setae; 4-6 upper proepisternal setae; 2, 3 postspiracular setae; 5-7 prealar setae; mesepimeron with 6-8 setae dorsad of scale patch. **Legs.** Posttarsi I-III (Fig. 29) with 2 ungues, I with ungues unequal in size, each with a tooth, II with ungues unequal in size, larger ungue simple and smaller ungue with a tooth, III with ungues equal in size, both simple. **Abdomen.** Tergum VIII wide, caudolateral area produced into a lobe bearing a patch of very long stout curved setae and median caudal area bearing a patch of moderately long to long stout setae. **Genitalia** (Fig. 11). Tergum IX moderately to heavily pigmented, band-like with median caudal margin slightly concave and strongly fused to tergum X, narrowly connected laterally to sternum IX; gonocoxite with sternal surface strongly produced ventrally, tergal surface with a few very long stout setae on lateral portion of apical area, ventral surface with apex slightly produced caudally and bears 2 long broad heavily pigmented longitudinally striated setae with bases nearly contiguous and apices bluntly pointed and one longer narrower stout lanceolate seta slightly ventrad of other 2, mesal subapical area with a small moderately to heavily pigmented bulla which bears a moderately long sternal arm, a short proximal conical tergal projection and a small distal lump, one moderately long seta between bulla and 2 broad apical striated setae, remainder of ventral surface with numerous short thin setae and a few broad scales, lateral surface with several long stout setae on apical area and a few broad scales on basal area; gonostylus moderately pigmented, long (approximately 1.1 length of gonocoxite), basal area formed into a large lobe with minute spicules and 8-10 short, moderately long and long stout setae, apical portion bifid, produced into a ventral shorter striated blade-like structure with a few minute spicules, and a dorsal narrow arm which is thicker distally and terminates in a short pointed hook, distal area bears 3-5 short thin setae and basal area of arm bears 3 moderately long stout setae, attached to apex of gonocoxite; basal mesal lobe lightly to moderately pigmented, consists of a small basal lobe bearing 8-13 short thin setae, each of which arises from a tubercle, and a small caudal lightly pigmented indistinct area on mesal membrane of gonocoxite bearing 1-3 very short setae, lobe connected mesally with its mate by a narrow moderately pigmented band covered with minute spicules and located ventrad of prosophallus and phallus; proctiger moderately pigmented, continuous tergally, paraproct not separated but restricted to a very heavily pigmented band along the sternal margin of proctiger, apex with 3-6 small heavily pigmented teeth; tergum X moderately to heavily pigmented, strongly fused to caudal margin of tergum IX and base of proctiger, margins indistinct but fusion lines somewhat wrinkled; phallosome complex, opisthophallus--composed of a moderately pigmented tergal transverse bridge between basal pieces, lateral surface curved ventrally, caudal margin with outer area produced into a cup-like lobe, base attached to a dorsomesal extension of the caudal portion of basal piece, phallus--composed of a pair of moderately long

aedeagal sclerites which are joined near their center by a narrow sternal bridge, apices of sclerites contiguous giving an A-shaped appearance, base of sclerite attached to inner tip of paramere, tergal area of sclerite basad of sternal bridge strongly fused to inner sternobasal portion of prosophallus, apex of phallus with a loosely attached tergal penis filament which consists of a small moderately pigmented U-shaped structure that is produced cephalad, prosophallus--composed of a pair of prosophallic sclerites each with a bulbous base which is fused to tergobasal area of phallus and tergomesal portion of paramere, apical 0.4-0.5 produced into several lightly pigmented flattened contiguous leaf-like structures with apices fused into a single flattened plate which is positioned between laterosternal surface of opisthophallus and lateral margin of phallus, prosophallic sclerite approximately equal in length to aedeagal sclerite, paramere--moderately long, approximately 0.67 length of aedeagal sclerite, articulated at a point near middle of outer margin with caudal area of basal piece, basal piece--moderately to heavily pigmented, moderately long; sternum IX with apicolateral areas rounded, 6-11 short and moderately long setae in a small patch near middle of caudal margin.

PUPA (Fig. 19). Chaetotaxy as figured and recorded in Table 1.

Cephalothorax. Moderately pigmented; lateralia without or with a small area of very poorly developed cuticular ocular facets of the compound eye; seta 5-CT with 4-7 branches. *Trumpet*. Heavily pigmented; index 4.13-5.60, mean 4.83. *Abdomen*. Terga I-III moderately pigmented; seta 1-II with 17-27 branches; 2-II laterad of 3-II; 1-III with 4-10 branches; 5-IV single or 2 branched; 1-V with 3-5 (usually 3, 4) branches; 1-VI with 4-6 branches, 3-VII with 4-9 (usually 5-7) branches; 6-VII with 4-8 branches; 9-VIII single.

Paddle. Ovoid; minute serrations on distal portion of basal 0.62 of outer margin; minute spicules on apical 0.38-0.41 of outer and apical 0.28-0.35 of inner margins; seta 1-P single, moderately long; index 1.17-1.58, mean 1.33.

LARVA (Fig. 24). Chaetotaxy as figured and recorded in Table 6. *Head*. Moderately pigmented; seta 4-C with 3-6 (usually 4, 5) branches; 5-C with 2-4 (usually 3) branches; 7-C with 5-7 (usually 5, 6) branches; dorsosentum with 21-26 teeth. *Antenna*. Moderately long; lightly pigmented; several small spicules scattered along entire length; seta 1-A with 6-9 branches, moderately long. *Thorax*. Seta 8-P single; 3-M with 3 branches. *Abdomen*. Seta 6-I with 2, 3 (usually 2) branches; 7-I single; 3-IV with 4-6 (usually 5, 6) branches; 4-VIII single; comb with 9-14 (usually 11, 12) scales arranged in a single curved irregular row, each scale with 1, 2 slightly stouter and longer median apical spines and smaller denticles on laterobasal areas; 4 short anal papillae. *Siphon*. Moderately pigmented; index 2.32-2.82, mean 2.53; pecten on basal 0.52-0.56 of siphon, composed of 9-12 (usually 10 or 12) spines, distal 2, 3 spines longer and wider spaced than remainder, each spine long, slender and with 1, 2 small stout ventral denticles near base; seta 1-S with 4-7 branches, short, attached on basal 0.64-0.71 of siphon distad of last pecten spine.

EGG. Description adapted from that of Matsuo et al. (1974: 440) and based on eggs collected in West Kalimantan, Indonesia. *Shape*. Apparently fusiform; anterior end with a gradual taper. *Size*. Length 630-720 (667 ± 8) microns; width 150-180 (172 ± 3) microns. *Chorion*. Egg chorion viewed with a scanning electron microscope (500 x) on upper (ventral) surface is as follows: reticulation composed of pattern of anteroposteriorly elongated polygonal cells, each cell with 1-5 large, roughly hemispherical papillae, small papillae between large papillae and ridge and are often confluent with them; reticulation of inner chorion with same pattern as outer chorion but with papillae absent.

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TYPE-DATA. The lectotype female of *Ae. butleri*, deposited in the British Museum (Natural History) (BMNH), possesses the following data on the adult labels: 28.10.99, Selangor, A. L. Butler; K. Selangor (mangroves) swarming; Klang jungle, Sept. [on the underside of a circular paper stage on which the adult is pinned]; *Aedes Butleri* (Type) Theobald; *Aedes butleri* Theobald, Holotype, P. F. Mattingly, 26:viii: 1955; T73.197 Term. [genitalia preparation]; and SEAMP Acc. No. 353. A discrepancy exists in the above label data in the month of collection, one label has September and another has October. Theobald (1901: 230), in his original description of *Aedes butleri*, reported that the time of capture was September and November, the habitat was Selangor (by A. L. Butler on 28.10.1899), and under observations stated that the collector said this species was very common, troublesome in Klang Jungle and swarmed in mangrove swamps. The original description was from 3 female syntypes (Theobald 1901: 230). Knight and Hull (1953: 476) noted one of the syntypes was not *Ae. butleri*, but probably a species in the subgenus *Skusea* Theobald. Mattingly (1956: 794) selected the above lectotype; a paralectotype with the following label data: 28.10.99, Selangor, A. L. Butler, Klang, very common & troublesome; and labeled the third specimen as a paralectotype (label data as follows: 28.10.99, Selangor, A. L. Butler) and transferred it to *Skusea*, confirming the identification of Knight and Hull.

DISTRIBUTION. Four specimens from Sri Lanka examined: 2♀ and 2♂.

SRI LANKA. *North Western*, Kurunegala Dist., Akaragama, 1933, Medical Entomologist of Ceylon, 2♂; *Southern*, Patwatte Ganga at Denipitiya, November 1946, 1♀; *Western*, Kalutara Dist., Matugama, Rest house, September 1921, H. F. Carter, 1♀ (cotype of *carteri*).

Specimens examined from other countries. BRUNEI, INDONESIA, MALAYSIA, PHILIPPINES, SINGAPORE and THAILAND.

Distribution from literature.

BRUNEI. Temburong Dist. (Reinert 1974b: 27).

INDIA. Andaman Islands (Barraud 1928: 373, 1934: 296; Brug and Bonne-Wepster 1947: 185).

INDONESIA. Celebes, Loewoe, Ceram, Piroe, Saparoea (Brug and Haga 1923: 639); Celebes, Ceram, Saparoea (Edwards 1924: 351); Southeast Borneo, Tanah Grogot, Java, Weltevreden (Brug 1924: 438); Tarakan Island, Borneo (Laffoon 1946: 344); Java, Borneo (Brug and Bonne-Wepster 1947: 185); Moluccas, Ceram, Wahaai, Hoelong, Wailoeloe, Celebes, Makassar, Borneo, Tanah Grogot (Huang 1968: 17); Borneo (Southeast), Tanah Grogot, Celebes, Loemae, Ceram, Java, Batavia, Kernajoran (Reinert 1974b: 27).

MALAYSIA (Leicester 1908: 197; Brug and Bonne-Wepster 1947: 185); Selangor, Klang Jungle (Theobald 1901: 230); Jugra, Kuala Lumpur (Theobald 1903b: 259, 1907: 548; Macdonald 1957: 23); Selangor, Perak, Dindings (Theobald 1910: 490, 495); Malaysian Peninsula (Edwards 1922a: 468); Dindings, Straits Settlements, Perak (Theobald 1903a: 295); Sarawak (Moulton 1914: 47); Rantau Panjang (1956 Ann. Rep. Inst. Med. Res., Fed. Malaya 1957: 107); Rantau Panjang, Sungei Sirek (between Klang and Port Swettenham) (Reid 1961: 46); Rantau Panjag, Delik, Tanah Puteh, Bukit Mandul (Wharton et al. 1964: 68); Pacific Tin (1965 Ann. Rep. Inst. Med. Res., Malaysia 1968: 23); Selangor (Huang 1968: 17); Carey Island, Jugra Forest Reserve (Univ. Calif. Internat. Center Med. Res. Ann. Prog. Rep. 1973: 3); Kedah, Kg. Sungei Lintang, Perak, Maxwell's Hill, Perlis, Kg. Gunong, Sabah, Beaufort, Jesselton, Kuala Abai, Kudat, Labuan, Sandakan, Tawan, Twaran, Selangor, Banting, Carey Island, Kampong Bandar, Klang, Kuala Lumpur, Kuala Selangor, Rantau Panjang, Sg. Bertek, Telak Gong (Reinert 1974b: 27); Gunong

Besout Forest Reserve (Univ. Calif. Internat. Center Med. Res. Ann. Prog. Rep. 1974: 72); Selangor, Kuala Lumpur Dist., Sungai Buloh Forest Reserve, Kepong Estate, Sabak Bernam Dist., Torkington Estate (Univ. Calif. Internat. Center Med. Res. Ann. Prog. Rep. 1979: 25, 27, 29).

PAPUA NEW GUINEA. Pionierbivak (Brug and Haga 1923: 639).

PHILIPPINES (? , Edwards 1922b: 468); Tacloban, Palo (Bick 1949: 2); Leyte, Tacloban (Huang 1968: 17); Leyte Prov., Tacloban, Palo, Palawan Prov., Iwahig, Puerto Princesa, Culion Island (Basio 1971: 32); Culion Island, Leyte, Palo, Puerto Princesa, Tacloban, Palawan Island, Iwahig Penal Colony, (Laffoon 1946: 344), Basbas Island, Tinabog (Reinert 1974b: 27).

SINGAPORE (Edwards and Given 1928: 345; Brug and Bonne-Webster 1947: 185; Colless 1957: 109; Vin-Coggrave and Pong 1964: 360); Macritchie Reservoir, West coast road between 8 and 9 mi (Reinert 1974b: 27).

SRI LANKA. Colombo (James 1914: 262); Kurunegala Dist., Akaragama (? , see discussion section below), Kalutara Dist., Matugama, Southern Prov., Denipitija, Polwatte Ganga (Wijesundara 1951: 175); Kalutara Dist., Matugama, Southern Prov., Potwatte Ganga at Denipitiya (Reinert 1974b: 27).

THAILAND (Brug and Bonne-Wepster 1947: 185; Thurman 1963: 52); Packnam, Trang (Causey 1937: 414); South Thailand (Iyengar and Menon 1956: 790); Chumporn Prov. (Harinasuta et al. 1970: 35); Chanthaburi Prov., Ban Bo Phu, Ranong Prov., Khao Muang Lak, Muang, Udorn Thani Prov., Nong Bau (Reinert 1974b: 27).

VIETNAM. Saigon, Ha-tien (Carter 1910: 276); Cochin China (Edwards 1922b: 468).

DISCUSSION. *Aedes butleri* is the type-species for Series II, Section A of the subgenus *Verrallina*. This species and *Ae. lugubris* are the only members of Series II from Sri Lanka. Females of *Ae. butleri* are distinguished from those of *Ae. lugubris* and other species in that *Ae. butleri* possesses abdominal terga II-VII with small laterobasal white scaled patches, terga without dorsal white scaled bands, paratergite and postspiracular area without scales, and mesokatepisternum with a few short fine setae cephalad of upper scale patch. Females of *Ae. lugubris* differ from *Ae. butleri* in the presence of a basal white scaled band on abdominal tergum II, scales present on the postspiracular area and mesokatepisternum without short fine setae.

Female genitalia of *Ae. butleri* are similar to those of *Ae. lugubris*, but can be easily separated by the shape of the lower vaginal sclerite, the spermathecal eminence, and the shape of the postgenital lobe (see Figs. 1, 4). These features also distinguish *Ae. butleri* from those of other species of the subgenus.

The male genitalia of *Ae. butleri* are very distinctive in the following features: gonocoxite strongly produced ventrally, apicoventral area with several modified setae and projections (see Fig. 11); gonostylus long, basal area formed into a large lobe, apical portion bifid; and basal mesal lobe consists of a small basal lobe bearing 8-13 short thin setae each arising from a tubercle, and a small caudal indistinct area bearing 1-3 very short setae.

Pupae can be separated from other Sri Lankan species by the following: trumpet index 4.13-5.60; seta 5-IV single or 2 branched; seta 6-VII with 4-8 branches; and seta 9-VIII single.

Aedes butleri larvae are distinguished from other species by the following combination of characters: seta 1-A with 6-9 branches; 7-C with 5-7 branches; 8-P single; 3-M with 3 branches; 7-T with 4-8 branches; 8-T with 2 branches; 7-I single; comb scales each with 1, 2 slightly stouter and longer median spines and smaller denticles on laterobasal areas; and pecten with 9-12 spines.

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No pupal or larval specimens of *Ae. butleri* were available from Sri Lanka, therefore, the descriptions and illustrations of these stages were based on specimens from other countries.

I have examined the male genitalia preparation reported as *Ae. butleri* by Wijesundara (1951: 175) from Alut Oya, North Central Province, and found it to be *Ae. lugubris*. Since Wijesundara must have used the description and illustration of Edwards (*in* Barraud 1934: 296, 297) to identify his specimens, the two males from Akaragama, Kurunegala District also were probably *Ae. lugubris*. Edwards' (1917: 222) and Edwards' (*in* Barraud 1934: 296, 297) male description and illustrations labeled *Ae. butleri* are actually those of *Ae. lugubris*.

BIONOMICS. Larvae were collected in Sri Lanka (as *Ae. carteri*) from a rain water puddle in dense shade (Wijesundara 1951: 177).

In Malaysia, Reinert (1974b: 27) reported that immatures were collected from a ground pool, hoofprints along the coast, a small ditch, a ground pool surrounded by nipa palms, small marshy depressions containing clear, colored or turbid, fresh or brackish, unmoving, temporary water in partially shaded areas located in secondary mangroves, coastal villages, villages with coconut palms and an orchard plantation, and at elevations from sea level to 45 m. Immatures also have been collected in Malaysia from pools in coastal swamps (Macdonald 1957: 23), from a hospital reservoir (Theobald 1907: 548), brackish pools in mangroves (Leicester 1908: 197), and from a cocoa pod (Ann. Prog. Rep., Univ. Calif. Internat. Center Med. Res. 1979: 30).

Immatures in Thailand were collected from small and large ground pools containing clear, fresh or brackish, unmoving, temporary water in partially or heavily shaded areas located in primary mangroves and at elevations from 3-26 m (Reinert 1974b: 27). Causey (1937: 414) collected larvae during May, June and October from pools of brackish water shaded by thick overhead vegetation.

Collections of immatures from the Philippines were made from mangrove swamps, swamp rain pools, a pool surrounded by nipa palms and a puddle with leaves containing brackish or fresh, unmoving water in partially shaded areas, and at elevations at and near sea level (Reinert 1974b: 28), and from a slightly brackish, shaded, leaf-filled puddle in a nipa palm swamp located at the extreme upper limit of the tidal zone and also from temporary, shaded, fresh-water, leaf-filled ground pools (Laffoon 1946: 244).

In Singapore, immatures were collected from small ground pools and a ground pool at the base of a coconut palm, containing colored, brackish, unmoving, temporary water in partially shaded areas located in an open swamp and a coastal village at sea level (Reinert 1974b: 28), a mangrove swamp, inundated land in a secondary jungle just above the tidal limits, transient brackish pools of the tidal zone, and a marshy pool at the jungle margin (Colless 1957: 109).

Immatures from Brunei were collected from a small ground pool containing clear, fresh, unmoving, temporary water in a heavily shaded area in a village at sea level (Reinert 1974b: 28).

In Vietnam, the larval habitat was reported as water in mangrove swamps, brackish pools, fresh water puddles and pools, pot holes and crab holes (Stojanovich and Scott 1965: 29, 1966: 134).

Wijesundara (1951: 176) collected a female (as *Ae. carteri*) from the bank of a river during November in the Southern Province of Sri Lanka.

In Malaysia, adults have been collected: biting man in mangroves, coconut groves, secondary rain forests and a village with nipa palms (Reinert 1974b:

28); at human bait at ground level (Ann. Prog. Rep., Univ. Calif. Internat. Center Med. Res. 1979: 25); from human- and monkey-baited traps (Ann. Rep. Inst. Med. Res. Malaysia for 1965: 23); from a Berok-baited trap on a platform (Ann. Rep., Inst. Med. Res. Malaysia for 1963: 48); from human-, goat- and calf-baited traps (Reid 1961: 52); and from human-baited traps at ground level and monkey-baited (*Macaca irus*) traps at ground and platform levels in both coastal mangrove and lowland swamp forest (Wharton et al. 1954: 68). Theobald (1901: 230) recorded adults as being very common and troublesome in the jungles and mangrove swamps of Malaysia and Macdonald (1957: 23) found them to be common in some coastal districts and to be vigorous biters during both the day and night but with peaks of activity during the hour after sunset (1800-1900 h) and the early morning after sunrise (0600-0800 h). *Aedes butleri* was reported to be a possible vector of dengue and Japanese B encephalitis on epidemiological grounds by Macdonald (1957: 4) and Reid (1961: 52). A virus (MM-2021) was isolated from *Ae. butleri* complex in Malaysia (Ann. Rep., Inst. Med. Res. Fed. Malaya for 1957: 134) and another virus (Group A) also was isolated from this species (Ann. Prog. Rep., Univ. Calif. Internat. Center Med. Res. 1974: 38). In Malaysia, of 132 *Ae. butleri* dissected, one was positive for *Dirofilaria* spp. parasites (Ann. Rep., Inst. Med. Res. Malaysia 1963: 48), however, all 58 specimens from Carey Island that were dissected were negative for filaria parasites (Ann. Rep., Inst. Med. Res. Fed. Malaya for 1957: 134).

Adults have been collected biting humans in coastal villages, a secondary evergreen forest and a rain forest in Singapore (Reinert 1974b: 28). Yin-Coggrave and Pong (1964: 360) collected females in Singapore during both the morning and afternoon with sweep nets. Colless (1959: 260) found that ox and man were the blood-meal source of *Ae. butleri* in Singapore using a precipitin test.

In the Philippine Islands, adults were taken biting man in mangrove swamps and coconut groves (Reinert 1974b: 28) and biting man during the daytime in mangrove swamps (Laffoon 1946: 244).

Females were captured biting man in a sago swamp during the day in Ceram, Indonesia (Huang 1968: 17).

In the Andaman Islands, India, Barraud (1928: 373) caught biting females in a forest.

Harinasuta et al. (1970: 35), working in Thailand, collected *Ae. butleri* from humans and found that all 390 specimens were negative for *Brugia malayi* parasites when they were dissected.

Aedes (VERRALLINA) INDICUS (THEOBALD)

(Figs. 2, 12, 20, 25, 28, 29, 31)

Neomacleaya indica Theobald 1907: 238 (♀), 1910: 243; Brunetti 1912: 458.

Skusea mediofasciata Theobald 1907: 544 (♀*, ♂*), 1910: 488.

Aedes (Aedes) indicus of Edwards 1913: 229, 1932: 176; Barraud 1934: 279, 280, 283 (♀*, ♂*, L*, keys); Carter 1950: 89; Wijesundara 1951: 175, 177, 178 (keys); Menon 1954: 141 (key); Qutubuddin 1960a: 136 (key).

Aedes indicus of Brunetti 1920: 143; Edwards 1922a: 264 (key); Senior-White 1923: 53.

Aedes (Aedes) indicus of Edwards 1922b: 468; Barraud 1928: 364-366 (♀*, ♂*, keys); Chow et al. 1954: 117; Horsfall 1955: 530; Stone et al. 1959: 206; Qutubuddin 1960b: 358; Aslamkhan and Salman 1969: 194.

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Aedes (*Neomacleaya*) *indicus* of Delfinado 1967: 24 (♀ *in part*, ♂*, L*, keys); Stone 1970: 153; Stone and Delfinado 1973: 303; Hochman and Reinert 1974: 7(L); Knight and Stone 1977: 116.

Aedes (*Verrallina*) *indicus* of Reinert 1974b: 17, 53 (♀*, ♂*, P*, L*), 1976: 206 (L); Knight 1978: 22, 35.

FEMALE (Fig. 31). *Head*. Antenna dark brown 0.98-1.06 length of proboscis, pedicel dark brown with a few small dark scales and short fine dark setae mesally, flagellomere 1 with basal 0.65 pale and with several small dark scales near middle; clypeus dark brown; maxillary palpus blackish-brown scaled, 0.16-0.20 length of proboscis; proboscis blackish-brown scaled, 1.14-1.26 length of femur I; eyes nearly contiguous; vertex with broad dark brown decumbent scales except for narrow curved white scales on interocular space, ocular line with narrow curved white scales, coronal suture with a single row of narrow curved white scales on each side and extending from occiput to near ocular line; ocular setae dark brown and well developed; occiput with a number of short brown erect forked scales and a few broad and narrow curved white scales; postgena with a narrow stripe of broad white scales extending from area in front of antepnotum to ocular line, lower area with broad creamy colored scales. *Thorax*. Scutal integument dark brown; scutum covered with narrow curved dark reddish-brown scales except for narrow curved white scales on anterior promontory area, anterior scutal fossal area, supraalar area and along lateral margins of prescutellar area; prescutellar area bare; dark reddish-black setae on following areas: 2-5 anterior promontory, numerous acrostichals (anterior and posterior), numerous dorsocentrals (anterior and posterior), scutal fossal (3-7 anterior, 3-8 lateral, 1-3 median and 2-5 posterior), several prescutellar, numerous antealar, and 5-7 posterior medial scutal; scutellum with a patch of narrow curved white scales on each lobe, a few similar brown scales basally on median lobe, 10-17 dark setae on lateral lobe and 10-14 dark setae on median lobe; pleural integument dark brown; antepnotum without scales, 13-24 long and short dark setae; postpronotum with narrow curved brown scales on upper area and several similar white ones on posterior area cephalad of setae, 4-8 posterior dark setae; proepisternum with a patch of broad white scales and 8-20 setae on upper area; postspiracular area with several narrow curved and occasionally a few moderately broad white scales, 6-10 dark setae; paratergite with a few narrow curved white scales laterally (rubbed off in some specimens); mesokatepisternum with an upper and a lower patch of broad white scales, 3, 4 upper and 9-15 lower dark setae; prealar area with 1-3 long moderately broad scales in some specimens, 9-14 dark setae; mesepimeron with a median patch of broad white scales, dorsal ones longer and somewhat narrower, 10-20 setae (several short and fine) dorsad of scale patch (a few long scales also usually dorsad of setae), 2-4 short fine golden setae along posterior margin of scale patch; other pleural areas bare. *Legs*. Coxae I-III with several dark setae, I with broad brown scales and a small dorsal patch of broad white scales on anterior surface, II, III with a patch of broad white scales on outer area of anterior surfaces; trochanters I-III with a few short setae and a few broad pale scales; femora I, II with anterior surfaces brown scaled, I with scales paler brown, II with a narrow longitudinal anteroventral pale stripe, III with most of anterobasal area pale scaled, I-III with a few white apical anterior and posterior scales, posterior surfaces mainly pale scaled, I with a narrow longitudinal posteroventral brown scaled stripe, II, III with a posterodorsal longitudinal brown scaled stripe that is narrow basally and broad apically; tibiae I-III dark brown scaled, I, III with a

broad posteroventral longitudinal pale scaled stripe, II with posterior surface pale scaled; tarsi I-III dark brown scaled; posttarsi I-III (Fig. 28) with 2 ungues, I, II with ungues equal in size, each with a tooth, III with ungues equal in size, both simple. *Wing*. Dorsal and ventral veins dark brown scaled; alula with several moderately broad and a few narrow brown scales on margin; upper calypter with several pale setae on margin; 1-3 remigial setae. *Halter*. Pedicel pale; capitellum creamy-white scaled with dorsal scales pale brown. *Abdomen*. Terga blackish-brown scaled with white markings as follows: I with a few dorsomedian white scales and a laterobasal patch of white scales, II-VII with a narrow laterobasal white scaled patch, II-IV and occasionally V also with a dorsomedian transverse white scaled band extending cephalad onto lateral margin and joined to lateral white scaled patches, VIII with a number of scattered white scales; sterna brown scaled with laterobasal pale scaled areas; terga and sterna with numerous golden setae, mostly along posterior margins. *Genitalia* (Fig. 2). Tergum VIII with numerous broad scales on apical 0.59-0.76, basal 0.40-0.65 retracted into segment VII, moderately pigmented with a lightly pigmented median basal area, wide, base slightly concave, apex gently convex, a number of short and moderately long thin setae at apex and similar ones scattered over apical 0.50-0.74; basolateral seta present, VIII-Te index 0.54-0.60, VIII-Te/IX-Te index 3.87-6.84, length 0.29-0.34 mm, width 0.50-0.59 mm; sternum VIII with numerous broad scales covering most of apical 0.75-0.87, moderately pigmented, wide, base concave mesally, apex with a shallow (0.04-0.06 of length) median indentation and with a small lobe on each side of midline, numerous moderately long setae apically, more numerous and slightly stouter on apical lobes, numerous short and a few moderately long setae scattered over apical 0.76-0.92, apical intersegmental fold unpigmented, VIII-S index 0.57-0.68, length 0.30-0.33 mm, width 0.36-0.55 mm; tergum IX moderately pigmented, very wide and short, ribbon-like, setae absent, IX-Te index 0.14-0.29, length 0.05-0.09 mm, width 0.28-0.35 mm; insula unpigmented, short, 3-7 small tuberculi, each with a small spicule; lower vaginal lip heavily pigmented, without spicules except a few on outer margin of hinge area, with a small caudally projected heavily pigmented median projection, lower vaginal sclerite composed of a pair of sigmoid-shaped heavily pigmented structures situated lateromesad on an elevated portion of the membrane which is extended over area between vaginal lip; upper vaginal lip heavily pigmented, complex, lateral surfaces formed into wide parallel plates which are produced into sharp posterior angles and are curved sternally and then mesally to form a continuous band, a stout arm extended mesally from near midpoint of dorsal surface of lateral area and formed into a large continuous upright shield which surrounds posterior portion of spermathecal eminence, spicules only along posterior margin of upper vaginal lip, upper vaginal sclerite heavily pigmented, extremely large and complex, base attached along entire lateral margin of upper vaginal lip except for a short posterior area, a large caudal arm extended mesally and formed into a crown around the posterior portion of the spermathecal eminence, posterior area of sclerite not pigmented, cephalic arm very large and formed into a continuous broad band around anterior of spermathecal eminence, wrinkled, fenestrated and with a mesal transverse slit; spermathecal eminence heavily pigmented, large, deep in depth, ovoid in dorsal outline, long spermathecal eminence spicules with lateral projections attached to cephalic area; spermathecal eminence, upper vaginal lip and upper vaginal sclerite cover nearly entire upper vaginal wall with heavily pigmented structures; postgenital lobe short, narrow, apex with a moderately deep (0.11-0.29 of dorsal length)

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median indentation, 5-15 setae on each side of midline, 11-28 total setae, dorsal PGL index 0.89-1.78, ventral PGL index 1.06-1.70, ventral length 0.08-0.13 mm; cercus with a number (14 or more) broad scales scattered over dorsal surface, triangular, moderately long, broad at base, apex acute, dorsal surface with a number of moderately long and a few short setae scattered over apical 0.87-0.94, ventral surface with several short and moderately long setae on outer 0.4-0.5, cercus index 2.95-3.97, cercus/dorsal PGL index 3.64-4.63, cercus length 0.30-0.36 mm; 3 spermathecal capsules, 1 large, 1 medium and 1 small, heavily pigmented, elliptical, each with a moderately broad neck, base of accessory gland duct unpigmented to lightly pigmented.

MALE. Essentially as in the female but with the following differences.

Head. Antenna plumose, 10, 11 setae in whorls, 0.98-1.14 length of proboscis; maxillary palpus 0.12-0.18 length of proboscis; proboscis 1.06-1.24 length of femur I; vertex without narrow scales on coronal suture. *Thorax.* Setal differences as follows: 2-4 anterior promontory; scutal fossal (3-6 anterior, 4, 5 lateral, 1, 2 lateral, 1, 2 median and 2-4 posterior); scutellum with 6-10 on lateral lobe and 6-12 on median lobe, 7-11 on antepronotum; 3-5 on postpronotum; 7-10 on upper proepisternum; 2, 3 on postspiracular area; 2, 3 upper and 7-10 lower on mesokatepimeron; 5-8 on prealar area; mesepimeron with 5-9 dorsad of scale patch and 1, 2 fine setae posterior to patch. *Legs.* Posttarsi I-III (Fig. 29) with 2 ungues, I, II with ungues unequal in size, larger one with a tooth, III with ungues equal in size, both simple. *Abdomen.* Terga with laterobasal white patches which usually extend slightly onto dorsal surfaces. *Genitalia* (Fig. 12). Tergum IX heavily pigmented, band-like with lateral areas broad, cephalic margin evenly concave, outer caudal margin fused to tergum X, broadly connected laterally to sternum IX; gonocoxite with apex of dorsal surface extended into a long broad flattened lobe with 2-5 short setae in a small patch on basomesal area, a number of short and long stout setae on apical 0.8, ventral surface with a number of short and long stout setae on apical 0.6, a number of broad scales on ventral and lateral surfaces; gonostylus moderately pigmented, moderately long (approximately 0.73 length of gonocoxite minus apical lobe), narrow, curved, base with a small lobe, apex pointed and tip recurved, 1-3 short thin setae subapically; basal mesal lobe moderately pigmented, composed of a basal lobe with 11-19 short thin dorsal setae and 10-22 short stout flattened acuminate setae on mesal surface, a broad flat extension onto mesal membrane of gonocoxite which bears 4-10 short fine setae and minute spicules, and an apical long curved arm which resembles the gonostylus, proctiger with paraproct formed into a heavily pigmented long slender slightly curved acuminate arm with basal area expanded and connected to tergum IX, base of proctiger lightly fused with tergum X; tergum X heavily pigmented, composed of a small rectangular plate laterad of paraproct base and extended ventrally from caudal margin of tergum IX; phallosome complex, opisthophallus--composed of a lightly to moderately pigmented tergal transverse bridge between basal pieces, caudal margin slightly indented mesally, sternobasal area attached to tergo basal portion of outer area of prosophallus, phallus--composed of a pair of moderately long aedeagal sclerites which are fused together by a narrow basal bridge that is extended laterally and is fused to tergo basal portion of prosophallic sclerite, apex of phallus formed into a tergal penis filament which consists of a small lightly pigmented sclerotized lobe and is produced cephalad, prosophallus--composed of a pair of moderately long acuminate prosophallic sclerites, each sclerite with distal portion heavily pigmented and slightly curved, proximal portion lightly pigmented, formed into a broadly rounded area which is attached to tergo mesal portion of paramere,

prosophallic sclerite approximately equal in length to aedeagal sclerite, paramere--approximately equal in length to aedeagal sclerite, articulated at a point approximately 0.65 from base with caudal area of basal piece, basal piece--moderately to heavily pigmented, moderately long; sternum IX with lateroapical areas rounded, 13-19 short and moderately long setae in an elongate patch along caudal margin.

PUPA (Fig. 20). Chaetotaxy as figured and recorded in Table 2. *Cephalothorax*. Moderately to heavily pigmented; lateralialia with moderately well developed cuticular ocular facets of the compound eye; seta 5-CT with 3-5 branches. *Trumpet*. Heavily pigmented; index 2.53-3.45, mean 2.88.

Abdomen. Terga moderately pigmented; seta 1-II with 4-7 (usually 6, 7) branches; 2-II laterad of 3-II; 1-III with 3, 4 branches; 5-IV with 2, 3 branches; 1-V single to 3 (usually 2) branched; 1-VI with 2-4 (usually 2) branches; 3-VII with 2-6 (usually with 2-4) branches; 9-VIII single or 2 branched. *Paddle*. Ovoid; minute serrations on most of basal 0.68-0.72 of outer margin; minute spicules on apical 0.35-0.38 of outer and apical 0.13-0.15 of inner margins; seta 1-P single, moderately long; index 1.43-1.68, mean 1.56.

LARVA (Fig. 25). Chaetotaxy as figured and recorded in Table 7. *Head*. Moderately to heavily pigmented; patch of small spicules over compound eye; seta 4-C with 2-5 (usually 4, 5) branches; 5-C with 3 branches; 5, 6-C with one branch noticeably longer than other branches; 7-C with 7-12 branches; dorso-mentum with 35-40 teeth. *Antenna*. Moderately long; moderately pigmented; several small spicules scattered along entire length; seta 1-A with 2, 3 branches, moderately long. *Thorax*. Seta 8-P with 2 branches; 3-M single to 3 (usually single) branched; 11-M with 2, 3 branches. *Abdomen*. Seta 6-I with 3, 4 branches; 7-I with 2 branches, occasionally with 3 branches; 3-IV with 5-7 branches; 1, 2-VIII attached to a small sclerite; 4-VIII single; comb with 8-12 (usually 8 or 10) scales arranged in a single curved irregular row, each scale with a stout median apical spine and small denticles on laterobasal areas; 4 moderately long anal papillae. *Siphon*. Moderately to heavily pigmented; index 1.68-2.37, mean 1.88; pecten on basal 0.56-0.65 of siphon, composed of 11-15 (usually 12-14) spines, distal 2 spines longer and wider spaced than remainder, each spine long, slender and with 1-3 small stout ventral denticles near base; seta 1-S with 3-5 branches, short, attached on basal 0.70-0.77 of siphon distad of last pecten spine.

EGG. Not known.

TYPE-DATA. The holotype female of *Ae. indicus* bears the following label data: *Neomacleaya indica* Type ♀ F. V. T.; India, S. Christophers; Nov. Spec., Nov. gen. nr. *Macleaya*, [a drawing of vertex of head and scutellum on label]; 27 [on a circular paper pinning stage]; Received from F. V. Theobald, 1907-29; T73.211 Term. [genitalia preparation number]; and SEAMP Acc. No. 374. The holotype is deposited in the BMNH and is in good condition (head and one leg are broken off and glued to the circular paper stage). The genitalia are mounted in balsam on a microscope slide.

DISTRIBUTION. Three hundred seventy-two specimens from Sri Lanka examined: 91♀ pl, 5♂ pl, 6♀ p, 20♂ p, 7♀, 13♂, 3 pl, 1 p and 5 L.

SRI LANKA. *Northwestern*, Puttalam Dist., Tabbowa, 26 July 1975, E. L. Peyton and Y-M. Huang, 3♀ pl, 1♀ p (364-1, -2, -3, -101), 1♂ (364), 1♂ pl, 1♀ p (365-1, -107), 4♀ pl, 1♂ p, 2 pl, 1 p (366-1, -2, -13, -17, -29, -30, -100, -101), 5♀ pl, 1♀ p, 2♂ p, (367-1 through -4, -42, -100, -101, -102), 17♀ pl, 1♂ pl, 1 l p, 1♀, 1♂, 1 pl (369-1, -2 through -17, -28, -55, -58, -59, -100), same except 27 July 1975, 6♀ pl, 2♀ p, 1♂ (371-1 through -6, -100, -101, -107), 9♂, 3 L (371), 1♂ pl (376-1), 7♀ pl (377-1 through -7), 41♀ pl,

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2♂ pl, 1♀ p, 16♂ p, 1♂ (378-1 through -33, -38 through -44 -46, -82, -100 through -116), 2 L (378), 8♀ pl (378-A-1, -8, -9, -11, -12, -13, -44, -67); Chilaw, November 1940, M. O. S., 1♀, 5 mi NNE of Puttalam, 1 February 1962, Per Brinck, Hugo Andersson and Lennart Cederholm, 1♀; *North Central*, Yan Oya, 24 mi west of Trincomalee, 10 February 1962, Per Brinck, Hugo Andersson and Lennart Cederholm, 2♀; Province not specified, Patanthaw, 20 March 1923, R. Senior-White, 1♀, Wordlands, 9 October 1907, E. Green, 1♀.

Specimens examined from other countries. INDIA.

Distribution from literature.

INDIA (Theobald 1907: 239; Edwards 1922b: 468); Punjab, Bihar, Pusa, Madras, Amritsar, Delhi, Karnal (Barraud 1928: 367, 1934: 286), Sind, United Prov., Saharanpur, Madras Town (Barraud 1934: 286); Bihar, Pusa, Delhi, Roshanara Gardens, Punjab, Amritsar, Karnal (Reinert 1974b: 57).

PAKISTAN. Lahore (Barraud 1928: 367, 1934: 286); Larkana (Barraud 1934: 286); Kohat Dist., Kohat-Hangu Valley (Qutubuddin 1960b: 358), Lahore Div., Changa Manga Forest (Aslamkhan and Salman 1969: 194).

SRI LANKA. Kurunegala Dist., Akaragama, North Western Prov., Chilaw (Wijesundara 1951: 175); Patanthaw (Reinert 1974b: 57).

DISCUSSION. *Aedes indicus* is the type-species for Series III, Section A of the subgenus *Verrallina*. Females of *Ae. indicus* are distinguished from those of other species by the following features: paratergite and postspiracular area with scales; postpronotum and mesokatepisternum without short fine setae in addition to the normal setae; mesepimeron with only 2-4 short fine setae posterior to the scale patch; and abdominal terga II-IV each with a dorsomedian transverse white scaled band, V also occasionally with a similar band. For additional information see the discussion section for *Ae. pseudomediofasciatus*.

The female genitalia can be separated from those of other species of the subgenus by the following: tergum IX index 0.14-0.29; lower vaginal sclerite composed of a pair of sigmoid-shaped structures; upper vaginal sclerite extremely large and complex (see Fig. 2); and spermathecal capsules each elliptical with a moderately broad neck.

Male genitalia of *Ae. indicus* are distinctive in the development of the gonocoxite which has the apex expanded into a long, broad, flattened lobe, the basal mesal lobe with numerous setae and an apically long curved arm resembling the gonostylus (see Fig. 12), and the paraproct which is composed of a long, slender, slightly curved, acuminate arm with the basal area expanded.

Pupae are distinguished by the following: trumpet index 2.53-3.45; seta 1-II with 4-7 branches; and seta 1-III with 3, 4 branches.

The larvae of *Ae. indicus* can be separated from other species by the combination of the following characters: a patch of small spicules over the compound eye; seta 1-A, 11-M and 7-I with 2, 3 branches; seta 8-P with 2 branches; 6-I with 3, 4 branches; and comb scales each with a stout, median, apical spine and with small denticles on laterobasal areas.

BIONOMICS. In the Northwestern Province of Sri Lanka, numerous collections of larvae were made from fresh, colored or turbid, unmoving water in small and large, shallow, ground and flood pools with abundant grass, in unshaded areas of a plain at 30 m altitude during July. One female was collected in February at a light during the rainy season in a marshy area with dense vegetation, in a place flooded by a river, and at an altitude of 2-5 m. In the North Central Province adults were collected during the rainy season (February) near a flooded river having a sandy bottom and shores, in a secondary dry forest and at an altitude of 50 m. Wijesundara (1951: 175)

reported that adults were taken during November from cattle-baited traps.

Females were collected in India biting at 0800 h (Barraud 1928: 367) and immatures from open pools and rain-filled ditches (Barraud 1934: 286).

In Pakistan, Aslamkhan and Salman (1969: 194) reported the following for *Ae. indicus*. Immatures were found in open ground pools and ditches filled by monsoon rain water. Adults first appeared in April, followed by a striking increase in numbers and peaked during the third week of June with the population then falling sharply, but with a little variation caused by temporary climatic changes during the monsoon. Numbers decreased considerably by the end of October. *Aedes indicus* predominantly fed on humans during the day; the man to cow ratio being 48: 1. It made up 43.2% of the total day-time human-biting collections. Females fed on cattle throughout the night although their biting activity was at its maximum in the late evening.

AEDES (VERRALLINA) LANKAENSIS STONE AND KNIGHT
(Figs. 3, 13, 28, 29)

- Aedes (Aedes) ceylonicus* Edwards 1917: 221 (♂*); of Edwards 1932: 175; Barraud 1934: 279, 288 (♀?, ♂*, key); Carter 1950: 89; Wijesundara 1951: 174, 178 (♀*, keys).
- Aedes ceylonicus* of Brunetti 1920: 145; Edwards 1922a: 264 (key); Senior-White 1923: 53, 1927: 62.
- Aedes (Aedes) ceylonicus* of Edwards 1922b: 468; Chow et al. 1954: 117; Horsfall 1955: 529.
- Aedes (Aedes) lankaensis* Stone and Knight 1958: 69 (*nom. nov. ceylonicus* Edwards 1917, *nec* Theobald 1910); of Stone et al. 1959: 207; Knight and Stone 1977: 71.
- Aedes (Aedes) lankaensis* of Qutubuddin 1960a: 138.
- Aedes (Neomacleaya) lankaensis* of Stone and Delfinado 1973: 303.
- Aedes (Verrallina) lankaensis* of Reinert 1974b: 17, 61 (♀*); Knight 1978: 15, 36.

FEMALE. Head. Antenna dark brown, 1.12-1.13 length of proboscis, pedicel brown with a few small brown scales and short fine setae mesally; clypeus brown; maxillary palpus dark brown scaled, 0.18-0.19 length of proboscis; proboscis dark brown scaled, 1.01-1.06 length of femur I; scales on head broad, dark brown and decumbent except for a few narrow curved brown scales on coronal suture and a stripe of broad white scales on postgena extending from in front of antepnotum to ocular line; occiput with a number of short brown erect forked scales, a few broad white decumbent scales and a number of narrow curved brown ones. **Thorax.** Scutal integument dark brown; scutum covered with narrow curved reddish-brown scales and with a few paler scales on anterior promontory and anterior scutal fossal areas; prescutellar area bare; dark brown setae on following areas: 2-4 anterior promontory, numerous acrostichals (anterior and posterior), numerous dorsocentrals (anterior and posterior), scutal fossal (4, 5 anterior, 3-5 lateral and 1 posterior), several prescutellar, numerous antealar, and 6 posterior medial scutal; scutellum with a patch of narrow curved reddish-brown scales on each lobe; 8, 9 setae on lateral lobe and 9 setae on median lobe; pleural integument dark brown; antepnotum without scales, 10-14 dark setae; postpronotum with narrow curved brown scales on upper area, 4-8 dark posterior setae; propisternum with a patch of broad white scales and 9, 10 setae on upper area;

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postspiracular area without scales, 3, 4 dark setae; mesokatepisternum with an upper and a lower patch of broad white scales, 3, 4 upper and 8-12 lower setae, lower ones shorter and pale; prealar area without scales, 7-12 dark setae; mesepimeron with a patch of broad white scales near center, 11-26 setae dorsad of scale patch, several fine golden setae along posterior and lower posterior margins of scale patch; other pleural areas bare. *Legs*. Coxae I-III with several setae, I with broad brown scales and a small dorsal and a small anteroventral patch of white scales, II, III with a patch of broad white scales on anterior surface; femora I, II with anterior and posterior surfaces brown scaled, I with a posterodorsal longitudinal white scaled stripe, II with a posteroventral longitudinal white scaled stripe, III with most of anteroventral and posteroventral areas white scaled, remainder brown scaled; tibiae I-III brown scaled, I also with a posteroventral longitudinal white scaled stripe, II also with a posteromedian longitudinal white scaled stripe; tarsi I-III brown scaled; posttarsi I-III (Fig. 28) with 2 ungues, I, II with ungues equal in size, each with a tooth, III with ungues equal in size, both simple. *Wing*. Dorsal and ventral veins with brown scales; alula with several narrow dark brown scales on margin; upper calypter with several dark setae on margin; 1, 2 remigial setae. *Halter*. Pedicel pale; capitellum brown scaled. *Abdomen*. Terga dark brown scaled with a large laterobasal white scaled patch; sterna white scaled with a narrow posterior brown scaled band; terga and sterna with numerous brown setae, mostly along posterior margin. *Genitalia* (Fig. 3). Tergum VIII with numerous broad scales covering apical 0.63-0.75, basal 0.35-0.50 retracted into segment VII, heavily pigmented, apex gently convex, several short thin and long stout setae apically, a few short setae on apical 0.24-0.40, basolateral seta absent, VIII-Te index 0.45, VIII-Te/IX-Te index 2.47-2.82, length 0.29-0.30 mm, width 0.65-0.66 mm; sternum VIII with numerous broad scales on most of area covered by setae, heavily pigmented, base concave mesally, apex with a small (0.10-0.11 of length) median indentation and with a small lobe on each side of midline, numerous short and moderately long setae apically, numerous short and a few moderately long setae on apical 0.74-0.83, basolateral seta absent, VIII-S index 0.61-0.63, length 0.32 mm, width 0.50-0.52 mm; tergum IX heavily pigmented, apex nearly straight, base slightly convex, setae absent, IX-Te index 0.26-0.27, length 0.10-0.12 mm, width 0.40-0.44 mm; insula unpigmented, short, 2-6 small tuberculi, each with a minute spicule; lower vaginal lip heavily pigmented, with minute spicules, lower vaginal sclerite composed of 2 long heavily pigmented plates which arise from laterobasal areas of upper vaginal lip, apex of sclerite slightly recurved and with a few short spicules; upper vaginal lip heavily pigmented, posterior margin rounded and with median area produced into a small caudally projected shield, upper vaginal sclerite heavily pigmented, large and complex, extended over most of upper vaginal wall; spermathecal eminence heavily pigmented, large, with a long narrow median opening, short to moderately long plumose spermathecal eminence spicules on basal 0.4-0.5 of outer margins of median opening; postgenital lobe long, narrow, apex with a small to moderately deep (0.15-0.26 of dorsal length) median indentation, 9-11 setae on each side of midline, 19-22 total setae, dorsal PGL index 0.65-0.76, ventral PGL index 0.43-0.47, ventral length 0.13-0.14 mm; cercus with scales absent, triangular, short to moderately long and broad at base, apex acute, dorsal surface with numerous short and moderately long setae on apical 0.93-0.97, 2 long stout setae at apex, ventral surface with several short setae along lateral margin, cercus index 2.32, cercus/dorsal PGL index 2.59, length 0.23-0.25 mm, width 0.10 mm;

spermathecal capsules, 1 large, 1 medium and 1 small, heavily pigmented, nearly spherical.

MALE. Essentially as in the female but with the following differences.

Head. Antenna plumose, 0.99-1.07 length of proboscis; maxillary palpus 0.11-0.13 length of proboscis; proboscis 0.93-1.15 length of femur I. *Thorax.* No apparent pale scales on anterior promontory and anterior scutal fossal areas; postpronotum with 3, 4 posterior setae; mesokatepisternum with 2, 3 upper and 6, 7 lower setae; prealar area with 5, 6 setae; mesepimeron with 9 setae dorsal of scale patch and only 3, 4 short fine setae along posterior margin of scale patch. *Legs.* Femora II, III with an anteroventral longitudinal white scaled stripe; posttarsi I-III (Fig. 29) with 2 ungues, I, II with ungues unequal in size, each with a tooth, smaller ungue tooth tiny, III with ungues equal in size, both simple. *Genitalia* (Fig. 13). Tergum IX moderately to heavily pigmented, band-like with lateral areas broad, cephalic margin slightly concave, caudal margin fused to tergum X, broadly connected laterally to sternum IX; gonocoxite with dorsal surface with apex extended into a short heavily pigmented bifid scissors-like lobe, 2 long stout setae at base of lobe, several moderately long and long setae on apical 0.5 of dorsal and lateral surfaces, a number of scales on outer margin of dorsal and on lateral surfaces, ventral surface with apex expanded into a short heavily pigmented knife-like spine, a patch of moderately long setae on apicomesal 0.5 and a patch of short setae on basomesal 0.4, several other setae on outer area; gonostylus moderately pigmented, short, cone-shaped with 2 long setae, one apical and the other at about middle of inner margin; basal mesal lobe moderately to heavily pigmented, consists of a sternobasal area covered with a number of short stout setae, several of which are heavily pigmented and spiniform, caudal area extended into a short lobe with 2 very heavily pigmented, very short, spiniform setae and a third slightly longer one more cephalad, a moderately pigmented band extends from sternobasal area to dorsomesal margin of the gonocoxite base, a large heavily pigmented sternally projected lobe arises at this location, basal portion of lobe large and apical part long and narrow, several stout setae at base of lobe; proctiger with paraproct reduced to a very small heavily pigmented lobe which projects ventrad; phallosome complex, opisthophallus--composed of a heavily pigmented tergal transverse bridge between basal pieces, caudal margin slightly convex and cephalic margin formed into a small flap, phallus--composed of a pair of very long aedeagal sclerites which are fused together by a narrow basal plate, apex of each phallic arm blunt, prosophallus--composed of a pair of moderately long prosophallic sclerites (apices of sclerites appear to have been damaged in specimens examined), proximal portion of sclerite attached to tergomesal portion of paramere, paramere-short, basal piece--heavily pigmented, moderately long; sternum IX with lateroapical margin extended into a pair of moderately long lobes with mesally curved apices, 27-31 short and moderately long setae on caudal 0.3, a few scales basad of setae.

PUPA, LARVA and EGG. Not known.

TYPE-DATA. The holotype male of *Ae. lankaensis* is deposited in the BMNH and bears the following information on the adult and genitalia slide labels: Ceylon, Colombo, K. McGahey [collector], 1914-510; *Aedes ceylonicus* Edw. Type [circular label with red border]; SEAMP Acc. No. 365; and *lankaensis* nom. nov. *ceylonicus*. Stone and Knight (1958: 69) proposed the name *lankaensis* as a new name for *ceylonicus* Edwards (1917) since the name was preoccupied by *ceylonica* Theobald (1910).

DISTRIBUTION. Ten specimens from Sri Lanka examined: 6♀ and 4♂.

SRI LANKA. *Western*, Colombo, K. McGahey, 1914, 1♂ (holotype),

Reinert: *Aedes* (*Verrallina*) of Sri Lanka

Colombo, 1♀, Yakkala, 18 mi NE of Colombo, 15-31 January 1962, Per Brinck, Hugo Andersson and Lennart Cederholm, 1♂, Ratmalana, vicinity of aerodome, October 1937, Medical Entomologist of Ceylon, 2♀, 1♂, Attidija, October 1937, Medical Entomologist of Ceylon, 1♀, Kulinjadiya, near Negombo, 17 January 1947, Medical Entomologist of Ceylon, 1♀; Province not specified, Ambalangoda, 10 February 1941, Medical Entomologist of Ceylon, 1♀; Location not specified, 1933, Medical Entomologist of Ceylon, 1♂.

Distribution from literature.

SRI LANKA (Edwards 1922b: 468); Colombo (Edwards 1917: 221; Barraud 1934: 288); Ganemulla, Toppur, Akaragama, Ratmalana (aerodome vicinity), Attidiya, Ambalangoda, Kegalle, Kulinjadiya near Negombo, Colombo (Wijesundara 1951: 174).

DISCUSSION. *Aedes lankaensis* belongs to Series III, Section A of the subgenus. The female abdominal terga IV-VII each possesses a large latero-basal white scaled patch that extends onto the dorsum, a feature which distinguishes it from several species.

The female genitalia of *Ae. lankaensis* are easily recognizable by the following features: lower vaginal sclerite composed of 2 long, heavily pigmented plates arising from the laterobasal areas of the upper vaginal lip; upper vaginal lip with the posterior margin rounded and with median area produced into a small caudally projected shield; large spermathecal eminence with a long narrow median opening and with short to moderately long plumose spicules on basal 0.4-0.5 of outer margins; postgenital lobe long and narrow with a small to moderately deep median indentation; and cerci short to moderately long, broad at base and triangular (see Fig. 3).

Male genitalia are distinctive in the following features: gonocoxite with apex extended into a short, heavily pigmented, bifid, scissors-like lobe; gonostylus short, cone-shaped and with 2 long setae; basal mesal lobe complex (see Fig. 13); paraproct reduced to a very small, heavily pigmented lobe that is projected ventrad; and sternum IX with a pair of moderately long, apically curved lobes on lateroapical margin.

BIONOMICS. Adults were collected during January, February and October. One male was found at an altitude of 30 m in a cultivated area with interspersed grass and brush and a lower area with ponds. Wijesundara (1951: 174) reared mixed collections of larvae found in a trench and in a pool, and reported adults had been collected in human- and cattle-baited traps, night traps, and indoors.

Aedes (*VERRALLINA*) *LUGUBRIS* BARRAUD
(Figs. 4, 14, 21, 28, 29)

- Aedes* (*Aedes*) *butleri* of Edwards 1917: 222 (♂*); Edwards in Barraud 1934: 279, 296, 297 (♂* only, key); Wijesundara 1951: 175, 178 (♂ only, key).
Aedes (*Aedes*) *lugubris* Barraud 1928: 365, 372 (♀*, key); of Laffoon 1946: 244; Horsfall 1955: 530; Macdonald 1957: 23; Stone et al. 1959: 207.
Aedes (*Aedes*) *lugubris* of Barraud 1934: 280, 294 (♀*, key); Edwards 1932: 176.
Aedes (*Neomacleaya*) *lugubris* of Delfinado 1968: 4, 8, 22 (♀*, ♂*, keys); Stone 1970: 154; Stone and Delfinado 1973: 303; Knight and Stone 1977: 117.
Aedes (*Verrallina*) *lugubris* of Reinert 1974b: 17, 66 (♀*, P*); Knight 1978: 22, 36.

FEMALE. Head. Antenna dark brown, 0.92-0.98 length of proboscis, pedicel medium brown with a few small dark scales and short fine setae mesally, flagellome 1 with a few small dark brown scales; clypeus dark brown; maxillary palpus blackish-brown scaled, 0.15-0.18 length of proboscis; proboscis blackish-brown scaled, 1.17-1.27 length of femur I; eyes nearly contiguous; vertex with broad blackish-brown decumbent scales except for a few broad white scales on posterior area along coronal suture; ocular setae dark brown and well developed; occiput with a number of short dark brown erect forked scales; postgena with a narrow stripe of broad white scales extending from area in front of antepnotum to ocular line. **Thorax.** Scutal integument dark brown; scutum covered with narrow curved dark reddish-brown scales except for a small patch of narrow curved white scales on anterior promontory and anterior scutal fossal areas; prescutellar area bare; blackish-brown setae on following areas: 2, 3 anterior promontory, numerous acrostichal (anterior and posterior), numerous dorsocentral (anterior and posterior), scutal fossal (3-5 anterior, 2-5 lateral and 1-3 posterior), several prescutellar, numerous antealar, and 6 posterior medial scutal; scutellum with a patch of narrow curved dark reddish-brown scales on each lobe, 7-13 dark brown setae on lateral lobe, 6-12 dark brown setae on median lobe; pleural integument dark brown; antepnotum without scales, 10-17 dark setae; postpnotum with narrow curved dark reddish-brown scales on upper area, 4-7 dark posterior setae; proepisternum with a patch of broad white scales and 8-12 setae on upper area; postspiracular area with a few broad white scales, 3-6 dark setae; mesokatepisternum with an upper and a lower patch of broad white scales, 1-4 upper and 8-12 posterior setae; prealar area with 8-11 dark setae; mesepimeron with a median patch of broad white scales, 9-18 dark setae dorsad of scale patch, a few short pale setae along posterior margin of scale patch; other pleural areas bare. **Legs.** Coxae I-III with several dark setae, I with broad brown scales and a small dorsal and a small ventral patch of broad white scales on anterior surface, II, III with a patch of broad white scales on anterior surface; trochanters I-III with a few short setae and a few broad pale scales; femora I-III with anterior surface dark brown scaled, III with a broad white scaled anteroventral stripe from base to near apex, I-III with posterior surface dark brown scaled, I with a posterodorsal narrow white scaled stripe from base to near apex, II, III with a broad posteroventral white scaled stripe from base to apex; tibiae I-III and tarsi I-III dark brown scaled; posttarsi I-III (Fig. 28) with 2 ungues, I, II with ungues equal in size, each with a tooth, III with ungues equal in size, both simple. **Wing.** Dorsal and ventral veins dark brown scaled; alula with several narrow brown scales on margin; upper calypter with several brown setae on margin; 1, 2 dark remigial setae. **Halter.** Pedicel pale; capitellum dark brown scaled with several pale scales apically. **Abdomen.** Terga blackish-brown scaled with white markings as follows: I, III, IV with a large laterobasal patch of white scales, patch extending onto lateral margin of dorsum on III and IV, II with a narrow white scaled basal band (some specimens with white band with a short median dorsal incomplete section), V-VII with a lateromedian white scaled patch which extends onto lateral margin of dorsum; sterna white scaled with posterior margins brown scaled; terga and sterna with numerous brown setae, mostly along posterior margins. **Genitalia** (Fig. 4). Tergum VIII with numerous broad scales covering apical 0.52-0.69, basal 0.5-0.6 retracted into segment VII, heavily pigmented, apex slightly convex, several short thin and long stout setae apically, a number of short setae on apical 0.34-0.48, basolateral seta absent, VIII-Te index 0.44-0.54,

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VIII-Te/IX-Te index 2.04-2.56, length 0.22-0.26 mm, width 0.47-0.50 mm; sternum VIII with numerous broad scales on most of area covered by setae, heavily pigmented with median area moderately pigmented, base moderately concave mesally, apex with a small (0.09-0.16 of length) median indentation and with a broad flat lobe on each side of midline, numerous short and moderately long setae apically, primarily on lobes, numerous short and a few moderately long setae on apical 0.78-0.85, basolateral seta absent, VIII-S index 0.47-0.55, length 0.22-0.27 mm, width 0.47-0.51 mm; tergum IX moderately to heavily pigmented, apex very slightly convex, base strongly concave mesally, setae absent (one specimen with 3 setae), IX-Te index 0.38-0.44, length 0.10-0.11 mm, width 0.23-0.27 mm; insula unpigmented, short, 4-6 small tuberculi, each with a small spicule; lower vaginal lip heavily pigmented, covered with minute spicules, lower vaginal sclerite composed of 2 submedian triangular moderately pigmented plates with a few minute spicules and with mesal margins jagged, a lightly pigmented wrinkled area between plates, and a pair of long narrow heavily pigmented plates attached to most of inner margins of lower vaginal lip; upper vaginal lip heavily pigmented, lateral area narrow and posterior margin with a moderately large posterolateral lobe and a small caudally projected median shield, covered with minute spicules, upper vaginal sclerite heavily pigmented, large, composed of a broad arm extending from base of upper vaginal lip caudomesad to spermathecal eminence and continued around its posterior margin as a narrow very heavily pigmented incomplete band; spermathecal eminence heavily pigmented, moderately large, composed of a median pair of teardrop-shaped structures each with a large triangular-shaped basal projection covered with small spicules and a long narrow arm with a very heavily pigmented pointed apex which lies on top of triangular projection, this structure with a number of short to moderately long spermathecal eminence spicules on lateral margin; postgenital lobe moderately long, moderately broad, apex flat or with a very small (0.00-0.10 of dorsal length) median indentation, 13-23 setae on each side of midline, 27-41 total setae, dorsal PGL index 0.84-1.03, ventral PGL index 1.05-1.31, ventral length 0.09-0.11 mm; cercus with a number of broad scales scattered over dorsal surface, triangular, moderately long and broad at base, apex acute, dorsal surface with numerous short and moderately long setae on apical 0.88-0.95, 2 long stout setae at apex, ventral surface with several short setae along lateral margin, cercus index 2.40-3.08, cercus/dorsal PGL index 2.70-3.26, length 0.24-0.27 mm; 3 spermathecal capsules, 1 large, 1 medium and 1 small, heavily pigmented, spherical, large one with a swollen neck, necks heavily pigmented, large one with numerous spermathecal pores and other 2 with a few pores near orifice, base of accessory gland duct lightly pigmented.

MALE. Essentially as in the female but with the following differences.

Head. Antenna plumose, 0.93-0.98 length of proboscis; maxillary palpus 0.11-0.12 length of proboscis; proboscis 1.17-1.22 length of femur I. *Thorax.* Anterior promontory area with 4, 5 setae; scutal fossal area with 4, 5 anterior, 3, 4 lateral and 1, 2 posterior setae; scutellum with 6-9 setae on lateral lobe, 7-10 setae on median lobe; anteprotonotum without scales, 8-12 setae; postpronotum with 3-5 setae; proepisternum with 5-9 setae on upper area; postspiracular area with scales usually absent, 2-4 setae; mesokatepisternum with 2 upper and 7-9 posterior setae; prealar area with 5-9 setae; mesepimeron with 10-13 setae dorsad of scale patch. *Legs.* Posttarsi I-III (Fig. 29) with 2 ungues, I, II with ungues unequal in size, larger ungue with a tooth, III with ungues equal in size, both simple. *Abdomen.* Tergum II without a dorsal white scaled basal band, lateral white scaled patches extending onto lateral margin of dorsum only

on VI, VII. *Genitalia* (Fig. 14). Tergum IX heavily pigmented, band-like with lateral areas broad, cephalic margin concave, caudal margin fused to tergum X, broadly connected laterally to sternum IX; gonocoxite with dorsal surface with a large circular basomesal indentation, several moderately long and a few long stout setae on apical 0.4 basad of gonostylus, ventral surface with apex produced into a long very heavily pigmented bifid structure which is directed mesocaudally, outer shorter arm truncated and inner longer arm bluntly pointed, basomesal area produced into a long arm with base broad and apical portion narrowed into a thumb and finger shaped structure, numerous short setae scattered over length of arm except apical area, a very heavily pigmented stout claw-like structure on caudobasal area, a number of setae on ventral surface of gonocoxite, basomesal setae short and apical setae long and stout, broad scales on laterobasal area of dorsal, on lateral and on a large laterobasal area of ventral surfaces; gonostylus attached slightly subapically to gonocoxite, heavily pigmented, moderately long, curved, basal 0.40-0.43 slightly swollen and with 13-21 moderately long setae, apical portion gently tapered to a blunt point and with a short thumb-like structure subapically; basal mesal lobe composed of a moderately pigmented band on sternal area of mesal membranous surface of gonocoxite, basal area formed into a small flattened lobe with 6-14 moderately long setae, apical area produced into a small tergally directed lobe with 5-9 short setae and a basal heavily pigmented curved spine bearing a moderately long setae; proctiger moderately pigmented, continuous tergally, paraproct not separated but restricted to a very heavily pigmented band along laterosternal margin of proctiger, apex a very heavily pigmented flattened plate; tergum X heavily pigmented, formed into a moderately large structure covered with short spicules, fused to caudal margin of tergum IX and base of proctiger; phallosome complex, opisthophallus--composed of a moderately pigmented tergal transverse bridge between basal pieces, caudal margin nearly straight, base attached to dorsomesal area of caudal portion of basal piece, phallus--composed of a pair of moderately long aedeagal sclerites which are joined near their center by a narrow sternal bridge, apices of arms contiguous giving an A-shaped appearance, base of arm attached to inner tip of paramere, basotergal area of sclerite fused to inner sternobasal portion of prosophallus, apex of phallus with a heavily pigmented, moderately long, cephalad projected, tergal penis filament with apex produced into a small pointed lobe laterally, prosophallus--composed of a pair of moderately long flattened prosophallic sclerites, each moderately to heavily pigmented and with apex rounded, approximately 0.75 length of phallic arm, paramere--moderately long, approximately equal in length to prosophallic sclerite, articulated at a point near middle of outer margin with caudal area of basal piece, basal piece--heavily pigmented, moderately long; sternum IX with lateroapical areas rounded, 12-22 short setae in a small caudomesal patch and 2 long setae basad of short ones.

PUPA (Fig. 21). Chaetotaxy as figured and recorded in Table 3.
Cephalothorax. Moderately to heavily pigmented; lateral area with a small area of very poorly developed cuticular ocular facets of the compound eye; seta 5-CT with 3-6 branches. *Trumpet*. Moderately pigmented; index 4.75-5.67, mean 5.11. *Abdomen*. Moderately pigmented with some heavily pigmented areas; seta 1-II with 18-37 branches; 2-II laterad of 3-II; 1-III with 5-8 branches; 5-IV, 3-VII with 2, 3 branches; 1-V, VI with 3-5 branches; 9-VIII with 3-6 (usually 3, 4) branches. *Paddle*. Ovoid; minute serrations on distal portion of basal 0.49 of outer margin; minute spicules on apical 0.48-0.51 of outer and apical 0.30-0.32 of inner margins; seta 1-P single or occasionally 2 branched,

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moderately long; index 1.20-1.36, mean 1.27.

LARVA and EGG. Not known.

TYPE-DATA. Barraud (1928: 372) originally described *Ae. lugubris* from 2 cotype females from Rangoon, Burma, collected on 20 May 1926, and indicated they were deposited in the collection of the Central Malaria Bureau, Kasauli, India. In 1934 (page 294), Barraud indicated one of the cotypes was in the BMNH and the other cotype was in the Malaria Survey of India collection (M. S. I.) in Kasauli. Delfinado (1968: 23) stated she had seen a female of *Ae. lugubris* labeled "type" in the BMNH and another female on a slide labeled cotype. I have examined the pinned adult female specimen in the BMNH and hereby designate it as the lectotype for *Ae. lugubris*. The lectotype bears the following data on the labels: Rangoon, Burma, Capt. R. W. Hamilton-Miller; 2093 [collection number]; P. J. Barraud, B. M. 1935-622; and Type ♀ [small circular label with red border]. The specimen is mounted on a minuten pin which is inserted into a small rectangular piece of cork attached to an insect pin. The lectotype is in fair condition with the genitalia intact, but with the following parts missing: both antennae, right hindleg, left foreleg, and all posttarsi except right midleg. The other cotype specimen is designated paralectotype.

DISTRIBUTION. One specimen from Sri Lanka examined: 1♂.

SRI LANKA. *North Central*, Alut Oya, 29 November 1921, 1♂.

Specimens examined from other countries. BURMA, INDIA, MALAYSIA and THAILAND.

Distribution from literature.

BURMA. Rangoon (Barraud 1928: 372; Delfinado 1968: 23).

INDIA. Andaman Islands, Port Blair (Barraud 1928: 372, 1934: 294), Andhra Pradesh, Godavari and Krishna Districts (Reuben 1978: 605).

MALAYSIA. Selangor (Delfinado 1968: 23); Rantau Panjang, Kampong Sireh (Macdonald 1957: 23); Kuala Selangor, Rantau Panjang (Reinert 1974b: 67).

THAILAND. Trat (?) (Reinert 1974b: 67).

DISCUSSION. *Aedes lugubris* belongs to Series II, Section A of the subgenus. See the discussion section of *Ae. butleri* for a comparison and comments on these 2 species. The description and illustration of *Ae. butleri* male genitalia by Edwards (*in* Barraud 1934: 296, 297) belong to *Ae. lugubris*, however, the description of the female was attributed to the correct species. The female is easily recognized by the single white scaled basal band on abdominal tergum II. Female genitalia are also distinctive (see Fig. 4).

Male genitalia of *Ae. lugubris* are easily recognized by the development of the gonocoxite which has the ventroapical area produced into a long, very heavily pigmented, bifid structure that is directed mesocaudally, the outer shorter arm is truncated and the inner longer arm is bluntly pointed, and the basomesal area of the gonocoxite is produced into a long arm with the base broad and apical portion narrowed into a thumb- and finger-shaped structure.

Pupae of *Ae. lugubris* have seta 3-VII with 2, 3 branches and 9-VIII with 3-6 branches which distinguish them from those of *Ae. butleri* which have seta 3-VII with 4-9 branches and 9-VIII single.

No female or pupal specimens were available from Sri Lanka; therefore, the descriptions and illustrations for these stages were based on specimens from India and Malaysia.

BIONOMICS. Wijesundara (1951: 175) reported the male (as *Ae. butleri*) was reared from a larva collected in a rain-filled depression in the ground at Alut Oya, Sri Lanka.

In Malaysia, pupae were collected from fresh, colored, unmoving water in small marshy depressions, in partially shaded areas located in a coconut orchard and females were taken biting man (Reinert 1974b: 67). Macdonald (1957: 23) collected larvae from ground pools among nipa palms and adults were taken from human- and animal-baited traps in Malaysia.

Aedes (Verrallina) petroelephantus WIJESUNDARA
(Fig. 5)

Aedes (Aedes) petroelephantus Wijesundara 1951: 176, 178 (♀*, key); of Qutubuddin 1960a: 135.

Aedes (Aedes) petroelephantus of Chow et al. 1954: 117; Stone et al. 1959: 208; Knight and Stone 1977: 71.

Aedes (Neomacleaya) petroelephantus of Stone and Delfinado 1973: 304.

Aedes (Verrallina) petroelephantus of Reinert 1974b: 17, 72 (♀*); Knight 1978: 15, 36.

FEMALE. *Head.* Antennal pedicel with a few small brown scales and short fine brown setae mesally; vertex with broad dark decumbent scales and a few narrow curved white scales along coronal suture; occiput with a few erect forked scales; eyes contiguous in front. *Thorax.* Scutal integument dark brown; scutum covered with narrow curved reddish-brown scales except for small patches of narrow curved white scales on anterior promontory and anterior scutal fossal areas; prescutellar area bare; numerous anterior and posterior acrostichal and dorsocentral setae; scutellum with narrow curved reddish-brown scales on each lobe; antepronotum without scales, 19-21 brown setae; postpronotum with narrow curved reddish-brown scales on upper area, 6 brown posterior setae; proepisternum with a patch of broad white scales and 19, 20 brown setae on upper area; subspiracular area, paratergite, mesomeron and metameron bare; postspiracular area without scales, 4, 5 brown setae; mesokatepisternum with a large upper and a smaller lower patch of broad white scales, 5, 6 upper and 13, 14 lower setae, lower ones shorter; mesepimeron with a large patch of broad white scales near center, 20, 21 setae dorsad of scale patch, several short fine golden-brown setae along posterior margin and lower posterior corner of scale patch. *Abdomen.* Wijesundara (1951: 176) stated that the terga are dark brown scaled with laterobasal white scaled patches that extend well onto dorsum and nearly form bands. *Genitalia* (Fig. 5). Tergum VIII with numerous broad scales covering apical 0.71, moderately pigmented, apex broad and nearly flat, a number of moderately long stout and several short setae on apical margin, numerous short setae on apical 0.39, basolateral setae present, VIII-Te index 0.46, VIII-Te/IX-Te index 3.11, length 0.26 mm, width 0.57 mm; sternum VIII with numerous broad scales on much of apical 0.86, moderately pigmented, base slightly concave mesally, apex with a small (0.1 of length) median indentation and with a small lobe on each side of midline, numerous short setae apically, numerous short and a few moderately long setae on apical 0.86, basolateral setae not seen, but specimen damaged in this area, VIII-S index 0.59, length 0.28 mm, width 0.47 mm; tergum IX moderately pigmented, base slightly concave, apex nearly flat, setae absent, IX-Te index 0.3, length 0.08 mm, width 0.28 mm; insula unpigmented, short, 5 small tuberculi, each with a minute spicule; lower vaginal lip heavily pigmented, with minute spicules, lower vaginal sclerite heavily pigmented, formed into a pair of moderately large plates

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which cover basal 0.5 of lower vaginal wall, plates connected at base; upper vaginal lip heavily pigmented, lateral area moderately broad, posterior margin more or less broadly rounded and produced into a caudally projected shield, upper vaginal sclerite heavily pigmented, consists of a moderately broad arm extended from laterobasal area of upper vaginal lip to lateral margin of spermathecal eminence; spermathecal eminence somewhat keyhole-shaped, apical portion rounded with upper surface formed into lateral points, basal portion elongated with base projected into a short lateral lobe, a number of short and moderately long simple and dentritic spermathecal eminence spicules on basal 0.7 of spermathecal eminence; postgenital lobe short, moderately broad, apex with a moderately deep (0.27 of dorsal length) median indentation, 12, 13 setae on each side of midline, 25 total setae, dorsal PGL index 1.18, ventral PGL index 0.82, ventral length 0.07 mm; cercus with scales absent, triangular, moderately long and moderately broad at base, apex acute, dorsal surface with numerous short and moderately long setae on apical 0.88, 2 long stout setae at apex, ventral surface with several short setae on lateral area, cercus index 3.0, cercus/dorsal PGL index 2.47, length 0.26 mm, width 0.09 mm; 3 spermathecal capsules, 1 large, 1 medium and 1 small, heavily pigmented, nearly spherical, base of accessory gland duct moderately pigmented.

MALE, PUPA, LARVA and EGG. Not known.

TYPE-DATA. The lectotype female of *Ae. petroelephantus*, deposited in the BMNH, possesses the following information on the labels: *Aed. (Aed.)* sp. new, Kurunegala, 16-12-22, Med. Entomologist, Ceylon; ♀ Hypo. No. 85; cotype; *Aedes (Aedes) petroelephantus* Wijesundara LECTOTYPE ♀, selected by J. F. Reinert, 10 July 1974. Paralectotypes were selected by Reinert (1974b: 72) for the other 2 female cotypes. These 2 specimens bear the same label data as the lectotype except for the genitalia preparation numbers--84 and 86. Only the genitalia of specimen No. 84 remains. Unfortunately the types were severely damaged in transit to the BMNH from Sri Lanka so that only fragments of the adults and the genitalia mounts remain. The adult of the lectotype is in very poor condition and consists of a twisted and rubbed thorax and head on a pin. The genitalia, however, were dissected and re-mounted (1974) in Canada balsam on a microscope slide and are in good condition.

DISTRIBUTION. Three specimens from Sri Lanka examined: 3♀.

SRI LANKA. North Western, Kurunegala, 16 Dec. 1922, 1♀ (lectotype) and 2♀ (paralectotypes).

Distribution from literature.

SRI LANKA. North Western Prov., Kurunegala (Wijesundara 1951: 176; Reinert 1974b: 72).

DISCUSSION. *Aedes petroelephantus* is still known only from the type-series. It belongs to Series III, Section A of the subgenus. This species is very distinctive in the development of the female genitalia and easily separated from those of other species of the subgenus by this character. The adult, however, is difficult to separate on habitus features from other species because of the limited number of features remaining on the severely damaged specimens. Wijesundara (1951: 176) stated that *Ae. petroelephantus* resembled *Ae. pseudomediofasciatus* in the adult habitus, but that the thorax was darker in the former species.

BIONOMICS. Nothing is known of the bionomics of this species except that the type-series was collected during December.

Aedes (Verrallina) pseudomediofasciatus (Theobald)
(Figs. 6, 15, 22, 26, 28, 29)

- Skusea pseudomediofasciata* Theobald 1910: 488, 489 (♂*, key).
Aedes pseudomediofasciatus of James 1914: 262.
Aedes (Aedes) pseudomediofasciatus of Edwards 1917: 222 (♂*), 1932: 176;
 Barraud 1934: 278, 280, 286, 289 (♀*, ♂*, keys); Carter 1948: 314, 1950:
 89; Wijesundara 1951: 173, 177, 178 (keys).
Aedes pseudomediofasciatus of Brunetti 1920: 145; Edwards 1922a: 265 (key);
 Senior-White 1923: 54, 1927: 62; Reuben 1971b: 129.
Aedes (Aedes) pseudomediofasciatus of Edwards 1922b: 468; Barraud 1928:
 364, 365, 367 (♀*, ♂*, keys); Chow et al. 1954: 117; Horsfall 1955: 530;
 Stone et al. 1959: 208; Reuben 1971a: 122; Rahman et al. 1973: 238;
 Knight and Stone 1977: 72.
Aedes (Neomacleaya) pseudomediofasciatus of Stone and Delfinado 1973: 304;
 Harrison et al. 1974: 153.
Aedes (Verrallina) pseudomediofasciatus of Reinert 1974b: 17, 75 (♀*, ♂*),
 1978: 225 (P*, L*); Knight 1978: 15, 37.

FEMALE. *Head.* Antenna dark brown, 1.08-1.14 length of proboscis, pedicel dark brown with a few small blackish-brown scales and short fine dark setae mesally, flagellomere 1 with basal 0.6-0.7 pale golden-brown and with several small broad blackish-brown scales on basal 0.5; clypeus dark brown; maxillary palpus blackish-brown scaled, 0.17-0.19 length of proboscis; proboscis blackish-brown scaled, 0.95-1.03 length of femur I; eyes contiguous; vertex with broad blackish-brown decumbent scales except for a few narrow curved white scales on upper interocular space, ocular line and along coronal suture from occiput to near ocular line; ocular setae blackish-brown and well developed; occiput with a number of short blackish-brown erect forked scales and a few narrow curved white decumbent scales; postgena with a narrow stripe of broad white scales extending from area in front of antepnotum to ocular line. *Thorax.* Scutal integument dark reddish-brown; scutum covered with narrow curved dark reddish-brown scales except for narrow curved white scales on anterior promontory area and usually a few on anterior scutal fossal area; prescutellar area with a narrow median stripe of dark reddish-brown scales; dark reddish-brown setae on following areas: 3-6 anterior promontory, numerous acrostichal (anterior and posterior), numerous dorsocentral (anterior and posterior), scutal fossal (3-8 anterior, 3-6 lateral and 1, 2 posterior), several prescutellar, numerous antealar, and 4-6 posterior medial scutal; scutellum with a patch of dark narrow curved reddish-brown scales on each lobe, 7-14 dark setae on lateral lobe and 6-10 dark setae on median lobe; pleural integument dark brown; antepnotum without scales, 8-13 dark setae; postpronotum with narrow curved dark reddish-brown scales on upper area; 4-7 dark posterior setae; proepisternum with a patch of broad white scales and 8-16 brown or golden setae on upper area; postspiracular area without scales, 2-5 dark setae; mesokatepisternum with an upper and a lower patch of broad white scales, 2-5 upper and 6-14 lower dark setae; prealar area without scales, 7-12 dark setae; mesepimeron with a median patch of broad white scales, 7-16 setae dorsad of scale patch, a few short fine pale setae at posteroventral corner of scale patch; other pleural areas bare. *Legs.* Coxae I-III with several setae, I with broad blackish-brown scales and a small dorsal patch of broad white scales and a small ventral patch of pale brown scales,

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II, III with a patch of broad white scales on anterior surfaces; trochanters I-III with a few broad pale scales, a few short setae; femora I, II dark brown scaled, I with a broad posterodorsal longitudinal white scaled stripe from base to apex, II with a narrow longitudinal anteroventral stripe of creamy colored scales on basal 0.7, II with a broad posteroventral longitudinal white scaled stripe from base to apex, III white scaled except for narrow brown scaled anterodorsal and posterodorsal longitudinal stripes, III with a small anteroapical and posteroapical white scaled patch, a similar white scaled patch usually on II; tibiae I-III dark brown scaled; tarsi I-III dark brown scaled; posttarsi I-III (Fig. 28) with 2 ungues, I, II with ungues equal in size, each with a tooth, III with ungues equal in size, both simple. *Wing*. Dorsal and ventral veins dark brown scaled; alula with narrow dark brown scales on margin; upper calypter with several dark setae on margin; 1-3 remigial setae. *Halter*. Pedicel pale; capitellum white scaled with a few brown scales basally. *Abdomen*. Terga blackish-brown scaled, I-VII with a laterobasal white scaled patch which extends posterodorsally and well onto dorsolateral areas of terga IV-VII; sterna II-VII white scaled with a narrow posterior band of brown scales, VIII with a few basal white scales; terga and sterna with a number of short brown and golden setae along posterior and lateral margins. *Genitalia* (Fig. 6). Tergum VIII with numerous broad scales on apical 0.61-0.78, basal 0.3-0.4 retracted into segment VII, moderately to heavily pigmented, apex slightly convex, several short and several long stout setae apically, numerous short setae on apical 0.38-0.50, basolateral seta absent, VIII-Te index 0.41-0.50, VIII-Te/IX-Te index 2.86-3.94, length 0.24-0.29 mm, width 0.55-0.61 mm; sternum VIII with numerous broad scales on most of area covered by setae, moderately to heavily pigmented, base slightly concave mesally, apex with a small (0.04-0.07 of length) median indentation and with a small lobe on each side of midline, numerous short and a few moderately long setae on apical 0.81-0.97, basolateral seta usually absent, VIII-S index 0.57-0.66, length 0.27-0.32 mm, width 0.47-0.53 mm; tergum IX lightly to moderately pigmented, base and apex both concave, setae absent, IX-Te index 0.30-0.38, length 0.07-0.09 mm, width 0.20-0.25 mm; insula unpigmented, short, 3-5 small tuberculi, each with a minute spicule; lower vaginal lip heavily pigmented, with minute spicules, with a small caudally directed heavily pigmented median projection, lower vaginal sclerite heavily pigmented, large and extended over most of lower vaginal wall, apex bilobed, numerous short fine spicules on apical area; upper vaginal lip heavily pigmented, posterior margin rounded and produced into a caudally projected shield, upper vaginal sclerite heavily pigmented, large and complex, extended over most of upper vaginal wall; spermathecal eminence heavily pigmented, large, triangular in dorsal outline, with moderately long, multiple branched spermathecal eminence spicules along most of outer margins of triangular area; postgenital lobe short, broad, apex with a very deep (0.52-0.76 of dorsal length) median indentation, 13-19 setae on each side of midline, 26-35 total setae, dorsal PGL index 0.47-0.73, ventral PGL index 0.62-0.93, ventral length 0.07-0.10 mm; cercus with a number of broad scales scattered over dorsal surface, triangular, moderately long and broad at base, apex acute, dorsal surface with numerous short and moderately long setae on apical 0.61-0.79, 2 long stout setae at apex, ventral surface with several short setae along lateral margin and apical 0.5, cercus index 2.16-2.63, cercus/dorsal PGL index 3.44-5.30, length 0.24-0.28 mm, width 0.09-0.12 mm; 3 spermathecal capsules, 1 large, 1 medium and 1 small, heavily pigmented, nearly spherical, each with neck heavily pigmented.

MALE. Essentially as in the female but with the following differences.

Head. Antenna plumose, 0.73-1.11 length of proboscis; maxillary palpus 0.10-0.14 length of proboscis; proboscis 1.03-1.19 length of femur I; vertex without narrow curved white scales on coronal suture; occiput without narrow curved white scales. *Thorax.* Anterior promontory area and anterior scutal fossal area without narrow curved white scales; postpronotum with only a few narrow curved reddish-brown scales and these restricted to posterodorsal area; setal differences are as follows: 2-5 anterior promontory, scutal fossal (3-5 anterior, 2-4 lateral and 1, 2 posterior), scutellar (4-8 on lateral lobe and 4-7 on median lobe), 5-10 anteprenotal, 3-5 postpronotal, 5-12 on upper area of proepisternum, 2-4 postspiracular, 1-3 upper and 5-9 lower meso-katepisternal, 4-9 prealar, and 5-7 upper mesepimeral. *Legs.* Posttarsi I-III (Fig. 29) with 2 ungues, I, II with ungues unequal in size, larger one with a tooth, III with ungues equal in size, both simple. *Wing.* One remigial seta. *Abdomen.* Terga with laterobasal white scaled patches not extending as far onto dorsum, VIII white scaled with a median posterior pale brown scaled area. *Genitalia* (Fig. 15). Tergum IX heavily pigmented, band-like with lateral areas broad, cephalic margin concave, caudal margin fused to tergum X, broadly connected laterally to sternum IX; gonocoxite with apex extended into a large flat lobe with 1-4 heavily pigmented teeth on mesal margin, lobe with 0-3 short setae on dorsal surface and 4-10 setae on ventral surface, dorsal surface with a few moderately long and long stout setae near middle and 2, 3 long stout setae at base of apical flat lobe, ventral surface with a few short setae near middle and several moderately long and long stout setae on apical 0.35-0.40 basad of apical flat lobe, numerous broad scales on outer dorsal, lateral and basal 0.5 of ventral surfaces; gonostylus subapically attached to gonocoxite, moderately to heavily pigmented, moderately long, curved, apex blunt with 2, 3 short setae, a short stout pointed subapical projection; basal mesal lobe composed of a long narrow to moderately broad strip located on mesal membrane dorsad of ventromesal sclerotized surface of gonocoxite, with numerous short and moderately long setae over most of length, some of these setae on tuberculi, 1-3 heavily pigmented long stout setae near middle of length; proctiger with paraproct bifid, formed into a pair of unequal long slender acuminate arms with dorsal arm longer, heavily pigmented basally, lighter apically, cercus short; phallosome complex, opisthophallus--composed of a moderately broad, moderately pigmented tergal transverse bridge between basal pieces, caudal margin emarginate, narrowly connected laterobasally to laterocaudal margin of basal piece, sternobasal area attached to tergo basal portion of outer area of prosophallus, phallus--composed of a pair of moderately long aedeagal sclerites which are fused together by a narrow basal bridge, apex of phallus formed into a small moderately pigmented U-shaped tergal penis filament, prosophallus--composed of a pair of moderately long, acuminate prosophallic sclerites, each sclerite moderately to heavily pigmented and with apex slightly curved mesad, proximal portion formed into a broadly rounded area which is attached to tergo mesal portion of paramere, paramere--approximately equal in length to aedeagal sclerite, articulated at a point approximately 0.5 from base with caudal area of basal piece, basal piece--heavily pigmented, moderately long; sternum IX with lateroapical areas rounded, 5-20 short and moderately long setae in an elongate posteromedian patch.

PUPA (Fig. 22). Chaetotaxy as figured and recorded in Table 4. *Cephalothorax.* Moderately pigmented; lateral area with moderately well developed cuticular ocular facets of the compound eye; seta 5-CT with 2-4 (usually 3, 4) branches; 8-CT with 2-4 branches. *Trumpet.* Moderately pigmented; index

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3.46-4.15, mean 3.69. *Abdomen*. Terga nearly all uniformly lightly pigmented; seta 1-II with 14-30 branches; 2-II laterad of 3-II; 1-III with 3-6 (usually 4-6) branches; 4-III single to 3 branched; 5-IV with 2, 3 (usually 2) branches; 1-V single or 2 branched; 1-VI single or 2 (usually single) branched; 3-VII with 2-4 (usually 3, 4) branches; 9-VIII single to 3 (usually 2) branched. *Paddle*. Ovoid; minute serrations on most of basal 0.64-0.69 of outer margin; minute spicules on apical 0.31-0.36 of outer and apical 0.21-0.30 of inner margins; seta 1-P single; index 1.35-1.57, mean 1.45.

LARVA (Fig. 26). Chaetotaxy as figured and recorded in Table 8. *Head*. Lightly to moderately pigmented; seta 4-C with 7-12 (usually 8-10) branches; 5-C with 5-9 (usually 6, 7) branches; 7-C with 9-17 (usually 10-12) branches; dorsomentum with 35-39 teeth. *Antenna*. Moderately long; lightly to moderately pigmented; a number of small spicules along entire length; seta 1-A with 4-6 branches, moderately long. *Thorax*. Seta 8-P single or 2 (usually 2) branched; 3-M single. *Abdomen*. Seta 6-I with 2 branches; 7-I single or 2 (usually single) branched; 1-II with 3-6 branches; 1-III with 7-12 branches; 3-IV with 3-5 (usually 4, 5) branches; 4-VIII with 2 branches; comb with 9-12 (usually 10) scales arranged in a single curved row, each scale with a moderately long median spine and with short denticles on laterobasal areas; 4 anal papillae, long and narrow. *Siphon*. Lightly to moderately pigmented; index 2.86-3.32, mean 3.12; pecten on basal 0.56-0.61 of siphon, composed of 10-14 (usually 10-12) spines, apical 2, 3 spines longer, without denticles and wider spaced than remainder, basal spines long, slender and with 1-3 (usually only 1) small ventral denticles near base; seta 1-S with 2-5 (usually 3, 4) branches, short, base attached on basal 0.70-0.73 of siphon distad of last pecten spine.

TYPE-DATA. Theobald (1910: 489) originally described *Ae. pseudomediofasciata* from 2 adult males collected at Peradeniya and Hakgala, Ceylon by Green in March and April 1907. He indicated the *type* was in the BMNH and that one of the males was dissected. His description was supplemented with illustrations of the wing (Fig. 211) and genitalia (Fig. 212). Parts of 2 males of this species are deposited in the BMNH. The first specimen is mounted on 2 thick glass slides both with similar paper labels with dashed border lines, however, the data are slightly different on the 2 slides. One slide has a wing mounted in balsam and contains the following information on the labels: *Skusea pseudomediofasciata* n. sp. ♂, Type, F. V. Theobald; Hakgala, Ceylon, E. Green, III. 1907; Recd. from F. V. Theobald, 1910-396. The other slide has a fore-, mid- and hindleg of a male mounted in balsam and label data as follows: *Skusea pseudomediofasciata* n. sp. ♂, F. V. T., Ceylon, E. Green; Recd. from F. V. Theobald, 1910-396. The second specimen is an adult male mounted on a minuten pin attached to a small rectangular paper point which is attached to an insect pin. The specimen has both wings, both forelegs and the left midleg intact. The genitalia are mounted in a drop of balsam on a small yellow plastic rectangular point attached to the adult insect pin. Labels attached to the insect pin possess the following data: *Skusea pseudomediofasciata* ♂, n. sp., Type, F. V. T.; Peradeniya, Ceylon, 4-07; Recd. from F. V. Theobald, 1910-396. The adult and genitalia of this specimen are in good condition. Since Theobald apparently marked both specimens as "type," I hereby select the male from Peradeniya as lectotype and the specimen from Hakgala (on slides) as paralectotype.

DISTRIBUTION. Four hundred eighty-eight specimens from Sri Lanka examined: 76♀ pl, 18♂ pl, 14♀ p, 37♂ p, 34♀, 42♂, 11 pl, 3 p and 3 L.

SRI LANKA. *Central*, Kandy Dist., Udawattekele, 22 June 1975, E. L.

Peyton and Y-M. Huang, 1♀ (07-100), 1♀ (18-1), 1♀ (24-100), 1♂ (29-109), 5♀ pl, 5♂ pl, 4♀ p, 5♂ p, 1♀, 3 pl, 1 p (43-2 through -12, -14, -101 through -111), 1♀ (43), same except 25 June 1975, 1♀ (111-101), Matale Dist. Matale, 26 June 1975, E. L. Peyton and Y-M. Huang, 1♂ p (126-108), Peradeniya, 1-15 February 1971, Piyadasa and Sompala, 1♀, Peradeniya, James, 1♀; *North Central*, Anuradhapura Dist., Hunuwilagama, Wilpattu, Wildlife Society bungalow, 10-19 March 1970, D. R. Davis and W. H. Rowe, 2♂, Anuradhapura Dist., Padaviya, Irrigation bungalow, 27 February-9 March 1970, D. R. Davis and W. H. Rowe, 1♂; *Northern*, Vavuniya Dist., Parayanalankulam, Irrigation canal 25 mi NW of Medawachchiya, 20-25 March 1970, D. R. Davis and W. H. Rowe, 2♀, 4♂; *North Western*, Puttalam Dist., Tabbowa, 26 July 1975, E. L. Peyton and Y-M. Huang, 1♂ (366-101); *Sabaragamuwa*, Vaddagala, Sinharaja Forest Reserve, 17 July 1975, E. L. Peyton and Y-M. Huang, 10♀ pl, 9♂ pl, 9♂ p, 8 pl, 1 p (286-2 through -27, -100 through -109), 7♀ pl, 1♀ p, 8♂ p (291-1 through -7, -100 through -107), 36♀ pl, 1♂ pl, 6♀ p, 3♂ p (295-1 through -36, -48, -100 through -107, -114), 1♀, 27♂, 3 L (295), 17♀ pl, 3♂ pl, 10♂ p, 1♀, 1 p (299-1 through -21, -100 through -110), Ratnapura Dist., Uggalkaltota, Irrigation bungalow, 31 January-8 February 1970, D. R. Davis and W. H. Rowe, 1♀, Kegalle, February 1941, Medical Entomologist of Ceylon, 1♀, Kitulgala, 21 mi N of Ratnapura, 17 March 1962, Per Brinck, Hugo Andersson and Lennart Cederholm, 1♂; *Southern*, Galle Dist., Kannelija, Sinharaja Forest, 14 July 1975, E. L. Peyton and Y-M. Huang, 1♀ pl, 3♀ p, 1♂ p (269-1, -100 through -104), Galandala, 16 mi NNE of Galle, 27 January 1962, Per Brinck, Hugo Andersson and Lennart Cederholm, 1♀, 2♂; *Western*, Yon-gammulla, 3 mi E of Yakkala and 18 mi NE of Colombo, 24 January-6 March 1962, Per Brinck, Hugo Andersson and Lennart Cederholm, 7♀, 1♂ Yakkala, 18 mi NE of Colombo, Dambuwa Estate, 1-14 February 1962, Per Brinck, Hugo Andersson and Lennart Cederholm, 3♀, 1♂; Province not specified, Badulla, 13 June 1933, Medical Entomologist of Ceylon, 2♀, Kurunegala, 25, 27 October 1925, Medical Entomologist of Ceylon, 4♀, 1♂, same except 1926, 1♀, Mantivu, December 1931, Medical Entomologist of Ceylon, 1♀, Udugama, October 1946, Medical Entomologist of Ceylon, 1♀.

Specimens examined from other countries. INDIA.

Distribution from literature.

INDIA (Edwards 1922b: 468); Nilgiri Hills (Barraud 1928: 367), Bombay Deccan, Kambarganvi, Dharwar Dist., South India, Kallar, Madras, Guindy, Madras Town (Barraud 1934: 286); Madras, North Arcot Dist., Kammavanpetti, Sathuperi (Reuben 1971a: 122, 1971b: 129); Tamil Nadu State, Coimbatore Dist., Kallar jungle (7-11 km from Mettupalaiyam) (Rahman et al. 1973: 239); Madras, Nilgiri Hills, Kallar (Reinert 1978: 227); Tamil Nadu, Thanjavur Dist., Pattukottai (Rajagopalan et al. 1979: 592).

SRI LANKA (Edwards 1922b: 468; Senior-White 1927: 62); Peradeniya, Hakgala (Theobald 1910: 490; Barraud 1928: 367), Colombo, Marble, Kurunegalla Dist. (Barraud 1934: 286); Colombo (James 1914: 262); North Western Prov., Munneswaram (near Chilaw), Hettipola, Hiripitiya, Wariyapola, Bandarakeswatta, Magulagama, Akaragama (near Kurunegala), Ridigama, Wegama, Kikaweratiya, Kuliypitiya, Maliawapitiya (near Kurunegala) (Carter 1948: 313); Ganemulla, Rambukkana, Kurunegala, Mantivu, Badulla, Udugama, Akaragama, Godakawela, Yakkalamulla, Labuduwa, Pannala, Kadugannawa, Matale, Avissawella, Wattegama (Wijesundara 1951: 173); North Central Prov., Anuradhapura Dist., Hunuwilagama, Wilpattu, Wildlife Society bungalow, Northern Prov., Vavuniya Dist., Parayanalankulam Irrigation canal 25 mi NW Medawachchiya, Sabaragamuwa Prov., Ratnapura Dist., Uggalkaltota, Irriga-

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tion bungalow (Harrison et al. 1974: 153), Central Prov., Kandy Dist., Peradeniya (Reinert 1974b: 76); Central Prov., Kandy Dist., Udawattekele, Matale Dist., Matale, North Western Prov., Puttalam Dist., Tabbowa, Sabaragamuwa Prov., Vaddagala, Sinharaja Forest Reserve, Southern Prov., Galle Dist., Kanneliya, Sinharaja Forest (Reinert 1978: 227).

DISCUSSION. *Aedes pseudomediofasciatus* is a member of Series III, Section A of the subgenus *Verrallina*. Females are easily separated from those of *Ae. indicus* by the absence of pale scaled bands on the abdominal terga and the paratergite without scales. The abdominal terga of *Ae. pseudomediofasciatus*, however, do have large laterobasal white scaled patches which curve posterodorsad and extend onto the dorsal areas of IV-VII. The postspiracular area of this species also is without scales. *Aedes pseudomediofasciatus* is separated from *Ae. yerburyi* by the absence of short fine setae on the postpronotum and mesokatepisternum.

Female genitalia of *Ae. pseudomediofasciatus* are distinctive and can be separated from the other species by the following features: lower vaginal sclerite large, covering most of lower vaginal wall, apex bilobed (see Fig. 6); spermathecal eminence triangular in dorsal outline and with spicules along most of outer margins; postgenital lobe broad and with a very deep median indentation; dorsal PGL index 0.47-0.73; and cercus index 2.16-2.63.

The male genitalia of *Ae. pseudomediofasciatus* are somewhat similar to those of *Ae. cautus* Barraud, but they can be easily distinguished by the development of the gonostylus, basal mesal lobe and apex of the gonocoxite. The apex of the gonocoxite of *Ae. pseudomediofasciatus* is variable (Fig. 15) in the number of teeth (1-4), however, the expanded, flattened shape is characteristic of this species. Other important features are the development of the basal mesal lobe with 1-3 heavily pigmented long stout setae near middle of length and paraproct bifid, formed into a pair of long slender acuminate arms with the dorsal arm longer, both arms with basal areas heavily pigmented and apical areas lightly pigmented.

Pupae of *Ae. pseudomediofasciatus* are similar to those of other members of *Verrallina* but can usually be separated from them by the combination of seta 8-CT with 2-4 branches, 1-II with 14-30 branches, 4-III single to 3 branched, 1-V, VI single or 2 branched, and trumpet index 3.46-4.15.

Senior-White (1927) illustrated the head and terminal segments of a larva which he determined to be *Ae. pseudomediofasciatus*. As Senior-White's illustration differed in a number of important features from the larval specimens with reared associated adults reported here, I believe his specimen was a different species (see discussion by Reinert 1978: 228). The larvae of *Ae. pseudomediofasciatus* can be distinguished from those of related species by a combination of the following features: seta 4-C with 7-12 branches; 5-C with 5-9 branches, all approximately equal in length; head capsule and siphon lightly to moderately pigmented; 6-I with 2 branches; 7-I usually single; 1-II with 3-6 branches; 1-III with 7-12 branches; 3-IV with 3-5 branches; 4-VIII with 2, 3 branches; and pecten composed of 10-14 spines.

BIONOMICS. In Sri Lanka, immatures were collected a number of times during June and July from colored or turbid, fresh, temporary, unmoving water, usually with leaves or grass, in small flood pools, a large shallow flood pool, large shallow ground pools, a wheel rut in a large ground pool, and a small animal footprint in a seepage area, located in partially shaded areas (twice in an unshaded area) of secondary rain forests (once in a cultivated field with secondary scrub), in mountainous terrain (once in a plain), and at altitudes from 30-915 m (usually between 600-610 m). Wijesundara

(1951: 174) records the immature habitats as borrow pits, coconut trenches, drains, depressions, pools and swamps.

In India, immatures were taken during May, July, September and October from clear or turbid, fresh, temporary, unmoving water in small ground pools located in arecanut palm plantations. Rahman et al. (1973: 239) reported larval habitats of *Ae. pseudomediofasciatus* in India as water in grinding stones (with cavities 30 cm deep and 20 cm wide and containing household refuse), cement tanks (with decaying organic matter), irrigation or artificial water channels (edged with grass), and arecanut beds (trees watered during dry season allowed 6-8 days standing water and contained decaying leaves and fruit).

Adults were collected with a sweep net in Sri Lanka in the Southern Province during January near a small stream in a forest reserve at an altitude of 50 m, in the Sabaragamuwa Province during March near a river in a rubber and tea plantation at an altitude of 60-150 m, and in the Western Province during January-March in a cultivated area with interspersed grass and bush and a lower area with ponds at an altitude of 30 m and a second location at a light near a stream. In Sri Lanka adults have been taken during January-March at an altitude of 30-60 m (Harrison et al. 1974: 153, Reinert 1974b: 76) and from human- and cattle-baited traps, river banks, in a house, and during January, February, May, June, August-October and December (Wijesundara 1951: 173). In the North Western Province, Carter (1948: 314) reported the following for *Ae. pseudomediofasciatus*: 3 (0.2%) of 1,342 females dissected from an endemic focus of filariasis were infected with *Brugia malayi* filaria, 7 (0.9%) of 775 were positive from villages where endemicity was slight, and 2 (11.1%) of 18 were positive from a non-endemic area (Akaragama).

In India, Rahman et al. (1973: 239) reported that adults fed on man in the jungle between 0800 and 2000 h and at an altitude of 300-450 m. Adults were also collected in India from bullock-baited traps, New Jersey light traps and resting outdoors in betel fields (Reuben 1971a: 122).

AEDES (VERRALLINA) SECULATUS MENON
(Fig. 16)

Aedes (Aedes) seculatus Menon 1950: 139 (σ^* , key); of Qutubuddin 1960a: 135, 136 (key).

Aedes (Aedes) carteri Wijesundara 1951: 176 (σ^* only, key, non Edwards 1936); Reinert 1974b: 85 (lectotype selection).

Aedes (Aedes) carteri of Chow et al. 1954: 117.

Aedes (Aedes) seculatus of Stone 1956 (1957): 339; Stone et al. 1959: 208; Knight and Stone 1977: 72.

Aedes (Neomacleaya) seculatus of Stone and Delfinado 1973: 305.

Aedes (Verrallina) seculatus of Reinert 1974b: 17, 84; Knight 1978: 15, 37.

FEMALE. Not known.

MALE. *Head.* Antenna brown, 1.01 length of proboscis, pedicel brown; clypeus dark brown; maxillary palpus dark brown scaled, 0.14 length of proboscis; proboscis dark brown scaled, 1.03 length of femur I; eyes narrowly separated in front; scales on head all broad, dark brown and decumbent except for a patch of broad white scales on postgena anterior to antepnotum, and a patch of dark brown erect forked scales on occiput; ocular setae dark brown and well developed. *Thorax.* Scutal and pleural integument dark reddish-

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brown; scutum covered with narrow curved reddish-brown scales (anterior area partially rubbed and pin extending through prescutellar area); dark setae on the following areas: 2 on anterior promontory, scutal fossal (5, 6 anterior and 2 lateral), numerous acrostichal (anterior and posterior), numerous dorsocentral (anterior and posterior), and several on lateral margins of prescutellar area; scutellum rubbed but with a few narrow curved reddish-brown scales on one lateral lobe, 6 setae on lateral lobe and 5 setae on median lobe; antepronotum with scales apparently absent, 11-13 setae; postpronotum with a few narrow curved brown scales on dorsal area (rubbed), 3-5 posterior dark setae; proepisternum with a few broad white scales and 8 setae on upper area; postspiracular area with 2-4 setae; mesokatepisternum with a large upper and a small lower patch of broad white scales, 4 upper and 6-8 lower setae; prealar area with 7, 8 setae; mesepimeron with a large patch of broad white scales near center, 6, 7 setae dorsad of scale patch, a very few short fine setae near lower posterior corner of scale patch; other pleural areas bare.

Legs. Coxae I-III with several setae, I with broad brown scales and a small dorsal patch of broad white scales on anterior surface, II, III with a small patch of broad white scales on anterior surfaces; trochanters I-III with a few broad white scales; femur I brown scaled with a posterodorsal longitudinal pale scaled stripe, III brown scaled with an anteroventral and a posteroventral longitudinal pale scaled stripe; tibiae I, III brown scaled; tarsomere I of tarsi I, III brown scaled (remainder of holotype legs missing). *Wing.* Dorsal and ventral veins with dark brown scales; alula with a few dark brown scales on margin. *Halter.* Pedicel pale; capitellum pale brown scaled with pale scales at apex. *Abdomen.* Terga I-VII dark brown scaled, each with a small laterobasal pale scaled patch; sterna pale scaled basally, brown scaled on posterior margins; terga and sterna with short setae mostly along posterior margins.

Genitalia (Fig. 16). Tergum IX heavily pigmented, band-like with lateral areas broader than median area, laterocaudal areas fused to tergum X, broadly connected laterally to sternum IX; gonocoxite with dorsal surface with several very long stout setae on apical and lateral 0.6, several scales on outer dorsal and lateral surfaces, ventral surface with apical area enlarged into a mesally projected lobe which is broad at the base and tapered to a claw-like apex, a similar claw-like structure basad of apex, numerous moderately long and long stout setae at base of apical lobe, numerous short and moderately long setae on remainder of ventral surface, more numerous on mesal area; gonostylus moderately long, narrow, heavily pigmented, sickle-shaped; basal mesal lobe moderately pigmented, consists of a long flat plate covering much of ventromesal surface of gonocoxite, extends from base of gonocoxite to point of articulation of the gonostylus, covered with numerous short setae, a short lobe at approximately midpoint of length, lobe bears 2 moderately long, stout, heavily pigmented, setae, 2 similar spiniform setae located on a very small protuberance slightly basad of lobe, 2 similar spiniform setae cephalad of protuberance, a few short stout setae on remainder of basal area; proctiger with paraproct formed into a heavily pigmented long slender curved bluntly pointed arm, basal area slightly expanded and connected to tergum IX; tergum X moderately pigmented, indistinct from tergum IX; phallosome complex, opisthophallus--composed of a moderately pigmented tergal transverse bridge between basal pieces, cephalic margin slightly concave, caudal margin uneven and projected into a large flap, phallus--composed of a pair of moderately long aedeagal sclerites which are fused near their bases, tergal surface of arms covered with a moderately pigmented strip, prosophallus--composed of a pair of moderately long, heavily pigmented prosophallic sclerites, apex of sclerite

blunt, basal portion expanded and attached to mesal portion of paramere, prosophallic sclerite approximately equal in length to phallic arm, paramere--approximately equal in length to aedeagal sclerite, basal piece--moderately to heavily pigmented, moderately long; sternum IX with lateroapical areas rounded, 7 short setae on caudal area.

PUPA, LARVA and EGG. Not known.

TYPE-DATA. The holotype male of *Ae. seculatus* is deposited in the BMNH and bears the following information on the adult and slide labels: *AEDEDES (AEDEDES) SECULATUS* n. sp. ♂; Vettoor, Pathanamthitta, Travancore, S. India; 14-8-1945; Coll. M. A. U. Menon; Type [circular label with red border]; SEAMP Acc. No. 365. Menon (1950: 139) stated that the type of *Ae. seculatus* was collected as an adult from a bush. The lectotype male of *Ae. carteri* (selected by Reinert 1974b: 85) is deposited in the BMNH and bears the following data on the adult and genitalia slide mount labels: type ♂, Hypo. No. 102, Matugama R. H. [Rest House], 2.9.21, Rainwater puddle in dense shade, pupa & larva skins, Med. Entomologist, Ceylon. Wijesundara (1951: 177) reported the type-male of *Ae. carteri* was collected in Kalutara District by H. F. Carter. Stone [1956 (1957): 339] stated that *Ae. carteri* was synonymous with *Ae. seculatus* and that this solved the problem of proposing a new name for *Ae. carteri* Wijesundara (1951) which was preoccupied by *Ae. (Banksinella) palpalis* var. *carteri* Edwards (1936) (*Ae. carteri* was subsequently treated as a subspecies by Edwards in 1941). Reinert (1974b: 84) agreed with Stone's synonymy of *Ae. carteri* with *Ae. seculatus*, but stated only the males were conspecific. The female cotype and an additional female of *Ae. carteri* are synonymous with *Ae. butleri*.

The holotype of *Ae. seculatus* is in fair condition, but parts of the head and thorax are rubbed and most of the tarsi are missing. The adult male lectotype of *Ae. carteri* is heavily damaged (only a thoracic fragment remains on the pin), but the genitalia, mounted in balsam on a slide, are in good condition.

DISTRIBUTION. One specimen from Sri Lanka examined: 1♂.

SRI LANKA. *Western*, Kalutara Dist., Matugama rest house, 2 September 1921, Medical Entomologist of Ceylon, 1♂ (lectotype of *carteri*).

Specimens examined from other countries. INDIA.

Distribution from literature.

SRI LANKA. Travancore, Pathanamthitta (Menon 1950: 139); Kalutara Dist., Matugama, Rest house (Wijesundara 1951: 176).

DISCUSSION. *Aedes seculatus* is a member of Series III, Section A of the subgenus. Reinert (1974b: 84) presents a discussion of the type-series of *Ae. carteri*, in which he confirmed the synonymy of the male with *Ae. seculatus* and indicated the females were conspecific with *Ae. butleri*. Therefore, the male is the only stage known for *Ae. seculatus*. The male genitalia of this species are very distinctive in the development of the following features: gonocoxite with apical area of ventral surface enlarged into a mesally projected lobe which is broad at the base and tapered to a claw-like apex, a similar claw-like structure basad of apex; gonostylus moderately long, narrow and sickle-shaped; and basal mesal lobe with numerous short setae and several long, stout, heavily pigmented, spiniform setae (see Fig. 16).

BIONOMICS. In Sri Lanka, Wijesundara (1951: 177) collected larvae from a rain water puddle in dense shade during September. Menon (1950: 139) collected a male from a bush in southern India during August.

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Aedes (Verrallina) spermathecus WIJESUNDARA
(Fig. 7)

- Aedes (Aedes) spermathecus* Wijesundara 1951: 175, 178 (♀*, key); of Qutubuddin 1960a: 135.
Aedes (Aedes) spermathecus of Chow et al. 1954: 117; Stone et al. 1959: 209; Knight and Stone 1977: 72.
Aedes (Neomacleaya) spermathecus of Stone and Delfinado 1973: 305.
Aedes (Verrallina) spermathecus of Reinert 1974b: 17.

FEMALE. No specimens known to be in existence. The following brief description is adapted from Wijesundara (1951: 175). *Head.* Maxillary palpus dark brown scaled, approximately 0.14 length of proboscis; vertex covered with dark brown scales, postgena with a patch of pale scales; occiput with a few brown erect forked scales. *Thorax.* Scutum dark brown scaled and black scaled on supraalar area at base of wing; antepronotum with setae on upper edge; postpronotum with posterior setae; mesepimeron with a median patch of flat creamy colored scales, several setae dorsad of scale patch, numerous fine setae ventrad of scale patch. *Legs.* Dark brown or blackish scaled except for ventral aspects of femora and tibiotarsal joints, which are pale scaled; posttarsus III with ungues simple. *Wing.* Dorsal and ventral veins dark scaled; length 3 mm. *Abdomen.* Terga scaling almost black in color with rather large laterobasal white scaled patches which do not extend onto dorsum. *Genitalia* (Fig. 7). Lower vaginal lip narrow; upper vaginal lip narrow, with posterior margin flat, posterolateral areas rounded, upper vaginal sclerite well developed, with a median posterior lobe; spermathecal eminence large, keyhole-shaped and with an underlying heart-shaped structure, spermathecal eminence spicules along bottom and lower 0.5 of lateral margins; postgenital lobe with a moderately deep median indentation, 12 setae on each side of midline; cercus triangular, moderately long, broad at base, and apex acute.

MALE, PUPA, LARVA and EGG. Not known.

TYPE-DATA. According to Wijesundara (1951: 175), *Aedes (Aedes) spermathecus* was described from 2 females collected from a cattle-baited trap at Weligama, Southern Province, Ceylon, in October 1941, and deposited in the collection of the Department of Entomology, Medical Research Institute, Colombo, Ceylon. The type-female of *Ae. spermathecus* Wijesundara unfortunately was destroyed during shipment from the Medical Research Institute to the BMNH (P. F. Mattingly, 24 Aug. 1954, personal communication). A letter (N. Jayasekera, 21 Feb. 1978, personal communication) from the Medical Research Institute stated that the type or any other specimens of *Ae. spermathecus* are not in that Institute's collection.

DISTRIBUTION. No specimens seen.

Distribution from literature.

SRI LANKA. Southern Province, Weligama (Wijesundara 1951: 175).

DISCUSSION. Wijesundara (1951: 175) stated, "It is a medium-sized species, darker than *A. pseudomediofasciatus*, (Theo.) in general appearance, and distinct from it and from all other known species of the sub-genus *Aedes* from India and Ceylon in the structure of the genitalia, the spermathecal eminence being of a distinctive shape."

BIONOMICS. Females were collected in Sri Lanka from a cattle-baited trap during October (Wijesundara 1951: 175).

***Aedes (Verrallina) srilankensis* Reinert**
(Figs. 8, 9, 17, 28, 29)

Aedes (Neomacleaya) uniformis of Harrison et al. 1974: 153.

Aedes (Verrallina) srilankensis Reinert 1977: 366 (♂*); of Knight 1978: 37.

FEMALE. *Head.* Antenna dark brown, 1.13-1.20 length of proboscis, pedicel dark brown, with a few small dark brown scales and short fine dark setae mesally, flagellomere I with basal 0.6 golden and with a few small broad pale brown scales; clypeus dark brown; maxillary palpus blackish-brown scaled, 0.17-0.18 length of proboscis; proboscis blackish brown scaled, 1.04-1.07 length of femur I; eyes separated in front; vertex covered with broad blackish-brown decumbent scales except for 2-4 narrow pale scales on interocular space and a few narrow semierect scales posterior to ocular line; occiput with a few short erect forked blackish-brown scales; postgena with dark blackish-brown scales except for a small patch of broad white scales on area anterior to antepnotum. *Thorax.* Scutal integument reddish-brown; scutum covered with narrow curved reddish-brown scales; dark brown setae on following areas: 2, 3 anterior promontory, numerous acrostichal (anterior and posterior), numerous dorsocentral (anterior and posterior), scutal fossal (2, 3 anterior and 3-5 lateral), several prescutellar, several antealar, and 4 posterior medial scutal; scutellum with narrow curved reddish-brown scales on each lobe, 4-7 dark brown setae on lateral lobe, 5-7 dark brown setae on median lobe; pleural integument reddish-brown; antepnotum with broad white scales on posterior surface, 7-9 dark brown setae; postpnotum without scales, 3-5 dark brown setae; proepisternum with a small patch of broad white scales and 4, 5 setae on upper area; postspiracular area without scales, 2-4 dark brown setae; mesokatepisternum with a small upper and a small lower patch of broad white scales, 1, 2 dark brown upper and 4-9 brown lower setae; prealar area without scales, 5-8 brown setae; mesepimeron with a median patch of broad white scales, 5-9 fine golden and brown setae dorsad of scale patch; other pleural areas bare. *Legs.* Coxae I-III with several brown setae, I with broad brown scales and a small dorsal patch of broad white scales on anterior surface, II, III with a small patch of broad white scales on anterior surfaces; trochanters I-III with a few pale brown scales and a few short brown setae; femora I-III dark brown scaled, I with a posterodorsal creamy-white scaled stripe extending from base to apex, II with a posteroventral creamy-white scaled stripe extending from base to apex, III with a few creamy-white scales on anteroventral area and a posteroventral longitudinal creamy-white scaled stripe extending from base to near apex, stripe broader basally, tibiae I-III dark brown scaled; tarsi I-III dark brown scaled; posttarsi I-III (Fig. 28) with 2 ungues, equal in size, each with a tooth. *Wing.* Dorsal and ventral veins dark brown scaled; alula with moderately broad brown scales on margin; upper calypter with several dark brown setae on margin; 1, 2 dark remigial setae. *Halter.* Pedicel pale; capitellum brown scaled. *Abdomen.* Terga blackish-brown scaled, I with a lateral patch of white scales; sterna II-VI dusty-white scaled on a blackish-brown integument, VII with basal 0.25 dusty-white scaled and apical 0.75 brown scaled, VIII brown scaled; several short golden or brown setae on posterior and lateral margins of terga and sterna. *Genitalia* (Figs. 8, 9). Tergum VIII with basal 0.35-0.60 retracted into segment VII, moderately to heavily pigmented, apex straight, several short and moderately long setae apically, numerous short setae and broad

Reinert: *Aedes (Verrallina)* of Sri Lanka

scales scattered over apical 0.38-0.63, basolateral seta small, VIII-Te index 0.58-0.67, VIII-Te/IX-Te index 2.0-2.4, length 0.17-0.21 mm, width 0.28-0.32 mm; sternum VIII with several broad scales scattered over area covered by setae, moderately to heavily pigmented with a median and a small latero-apical lightly pigmented area, base concave mesally, apex with a small (0.09-0.14 of length) median indentation and with a small lobe on each side of midline, numerous short stout heavily pigmented setae on lobes, numerous short and a few moderately long setae scattered over apical 0.61-0.82, basolateral seta absent, VIII-S index 0.48-0.62, length 0.17-0.21 mm, width 0.33-0.37 mm; tergum IX moderately pigmented, base concave, apex with a moderately deep median indentation, setae absent, IX-Te index 0.41-0.48, length 0.84-0.93 mm, width 0.19-0.21 mm; insula absent, however, medial apical area of lower vaginal lip and sclerite apparently serves in the capacity of the insula since it is situated in the insula's normal position and lies in the space between the median apical lobes of sternum VIII; lower vaginal lip heavily pigmented, forming a narrow band along basal 0.75 of area, apical 0.25 poorly developed and indistinct from median area of lower vaginal sclerite, base attached near midpoint of lateral portion of upper vaginal lip, covered with small spicules, lower vaginal sclerite forming a heavily pigmented ribbon-like strip attached to lower vaginal lip and extended mesally at which point it is fused to its mate and forms a U-shaped structure which replaces the insula, base of sclerite articulated with the lateral wing-like projection of the spermathecal eminence "pouch"; upper vaginal lip moderately to heavily pigmented, narrow, median posterior portion moderately pigmented and projected into a large heavily pigmented cephalic shield which covers most of spermathecal eminence, upper vaginal sclerite well developed, base moderately pigmented and attached along entire mesal margin of upper vaginal lip, sclerite produced into a large heavily pigmented arm which extends mesad and is attached to spermathecal eminence, apical area of sclerite with short spicules; spermathecal eminence heavily pigmented, egg-shaped in dorsal outline, a large heavily pigmented cephalad produced pouch attached to anterior tergal portion of spermathecal eminence, pouch with inner surface lined with numerous long stout spines and with a laterobasal wing-like structure on each side; postgenital lobe short, narrow, apex with a minute to small (0.02-0.08 of dorsal length) median indentation, 6-9 setae on each side of midline, 13-17 total setae, dorsal PGL index 1.00-1.29, ventral PGL index 1.68-2.13, ventral length 0.10-0.11 mm; cercus with a number of broad scales scattered over dorsal surface, triangular, moderately long and moderately broad at base, apex acute, dorsal surface with numerous short and a few moderately long setae on apical 0.87-0.95, 2 long setae at apex, ventral surface with a few short setae along lateral margin, cercus index 3.57-4.27, cercus/dorsal PGL index 3.00-3.64, length 0.19-0.22 mm, width 0.05-0.06 mm; 3 spermathecal capsules, 1 large, 1 medium and 1 small, heavily pigmented, nearly spherical, base of accessory gland duct moderately pigmented.

MALE. Essentially as in the female but with the following differences.

Head. Antenna 1.24 length of proboscis; maxillary palpus 0.17 length of proboscis; proboscis 1.07-1.09 length of femur I. *Thorax.* Setal differences as follows: scutal fossal (2 anterior and 2, 3 lateral); scutellar (3-5 on lateral lobe and 4 on median lobe); 5, 6 anteprenotal; 2 postprenotal; 6-8 upper proepisternal; 1-3 postspiracular; 2 upper and 6-8 lower mesokatepisternal; 3-5 prealar; and 6-8 upper mesepimeral. *Legs.* Posttarsi I-III (Fig. 29) with 2 ungues, I, II with ungues unequal in size, each with a tooth, III with ungues equal in size, each with a tooth. *Genitalia* (Fig. 17). Tergum IX

moderately to heavily pigmented, formed into a narrow band mesally and expanded caudolaterally into a pair of long, heavily pigmented, blunt, thumb-like processes, bases of processes fused to tergum X, connected laterally to sternum IX by a narrow heavily pigmented band; gonocoxite with tergo-basal portion membranous, dorsal surface with apex extended into a moderately long lobe which bears 3, 4 moderately long, heavily pigmented, blunt or pointed, flattened spiniform setae, several long stout setae basad of lobe, ventral surface produced into a large apicomeral lobe which is heavily pigmented on both tergal and sternal areas, tergomeral area of lobe with a few scattered short fine setae, sternal area of lobe with numerous short fine setae which extend basad onto apical 0.5 of ventral surface, ventral surface also with several long stout setae on outer margin and a few broad scales; gonostylus heavily pigmented, moderately long, approximately 0.56 length of gonocoxite, basal 0.22 moderately broad, middle 0.33 expanded and with 20-23 short thin setae, apical 0.45 narrow, recurved and with apex very heavily pigmented and folded back; basal mesal lobe broad, moderately to lightly pigmented, covered with small spicules, 8-10 very short fine setae near basomesal area, 2 heavily pigmented short spine-like structures near middle of tergomeral margin, lobes connected mesally by a moderately broad band which forms a shallow trough ventrad of apical portion of prosophallic sclerites, sternomesal margins of basal mesal lobe fused with gonocoxite; proctiger with paraproct heavily pigmented, formed into a long, caudally projected, strongly curved arm which is moderately broad basally and apically acuminate and curved mesad; tergum X heavily pigmented, formed into a plate between proctiger and caudomesal portion of tergum IX, connected by a small very heavily pigmented strip mesally; phallosome complex, opistophallus--composed of a moderately pigmented tergal transverse bridge between the basal pieces, caudal margin produced into a moderately long flap, cephalic margin concave, base attached to a dorsomesal extension of the caudal portion of the basal piece, phallus--composed of a pair of short aedeagal sclerites which are fused at the base, apex of phallus formed into a tergal penis filament which extends cephalad, prosophallus--composed of a pair of long heavily pigmented acuminate prosophallic sclerites which have their bases widely separated and their apices nearly contiguous, apical portion of prosophallic sclerite projected caudad of phallus, prosophallic sclerite approximately 2.29 length of aedeagal sclerite (measured along midline of genitalia), paramere--broad, long, approximately 1.32 length of phallic sclerite, basal piece--heavily pigmented, very long, approximately 1.92 length of paramere; sternum IX strongly attached along lateral surface to sternomesal areas of gonocoxite, 11, 12 short setae near center of caudal area.

PUPA, LARVA and EGG. Not known.

TYPE-DATA. The holotype male bears the following information on the labels: SRI LANKA, Western Province, Yakkala, 18 miles NE of Colombo, 1-14 Feb. 1962, collection locality 10, sweepnet, Per Brinck, Hugo Andersson and Lennart Cederholm [collectors], Lund University Ceylon Expedition 1962, T77.13 Term. [genitalia preparation number], *Aedes (Verrallina) srilankensis* Det. John F. Reinert. The paratype male possesses the same data as the holotype except the genitalia preparation number (T77.11 Term.). Brinck et al. (1971: XXIII) list the following additional data for collection locality 10: Dambuwa Estate, altitude 30 m, cultivated area (coconut, paddy fields, fruit gardens) with interspersed grass and brush areas and a lower moist part with ponds. The holotype (adult and genitalia both mounted in Canada balsam on 2 microscope slides) is deposited in the United States National

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Museum of Natural History (USNM) and the paratype (adult and genitalia both mounted on 2 microscope slides) is deposited in the University of Lund Museum, Lund, Sweden.

DISTRIBUTION. Fourteen specimens from Sri Lanka examined: 12♀ and 2♂.

SRI LANKA. *Northern.* Vavuniya Dist., Parayanalankulam, Irrigation canal 25 mi NW Medawachchiya, 20-25 March 1970, D. R. Davis and W. H. Rowe, 6♀; *Uva*, Westminster Abbey, 25 mi ESE Bibile, 7 March 1962, Per Brinck, Hugo Andersson and Lennart Cederholm, 1♀; *Western*, Yakkala, 18 mi NE Colombo, 1-14 February 1962, Per Brinck, Hugo Andersson and Lennart Cederholm, 1♂ (Holotype) and 1♂ (paratype), same except 15-31 January 1962, 2♀, Yongammulla, 3 mi E Yakkala and 18 mi NE Colombo, 24 January-6 March 1962, Per Brinck, Hugo Andersson and Lennart Cederholm, 3♀.

Distribution from literature.

SRI LANKA. Northern Prov., Vavuniya Dist., Parayanalankulam, Irrigation canal 25 mi NW Medawachchiya (Harrison et al. 1974: 153); Western Prov., Yakkala, 18 mi NE Colombo (Reinert 1977: 368).

DISCUSSION. *Aedes srilankensis* is the only member of Section B from Sri Lanka. The adults possess posttarsi III with the ungues toothed, eyes separated in front, mesepimeron without fine setae caudad or ventrad to scale patch, postpronotum without scales, and antepronotum with broad white scales. Adults of *Ae. srilankensis* are very similar in habitus to those of *Ae. uniformis* and except for the male and female genitalia, no reliable features could be found to separate the 2 species.

The female genitalia are characteristic of Section B and have the insula replaced with a U-shaped median apical projection of the lower vaginal sclerite, the upper vaginal lip with the median posterior area produced into a large horizontal shield which extends over the spermathecal eminence, and the spermathecal eminence with a spine-lined pouch. Female genitalia of *Ae. srilankensis* are similar to those of *Ae. uniformis*, but can be easily separated by the shape of the horizontal shield of the upper vaginal lip (Fig. 9). The distal portion of this structure is pointed in *Ae. srilankensis* and truncated in *Ae. uniformis*.

Male genitalia of *Ae. srilankensis* also clearly belong to Section B of the subgenus in having the prosophallus very long, phallus short and 0.44 length of the prosophallus, paramere very long, and basal piece very long. In addition, the male genitalia of *Ae. srilankensis* are easily distinguished by the long thumb-like processes of tergum IX, shape of the gonostylus, and the dorso-apical lobe of the gonocoxite which bears 3, 4 heavily pigmented, flattened spiniform setae.

BIONOMICS. The type-series males were collected in the Western Province with a sweep net from a cultivated area with interspersed grass and brush areas and a lower area with ponds at an altitude of 30 m during February (Reinert 1977: 368). Females were taken with a sweep net during January from the type-locality and a few miles away in an insect trap at 30-90 m altitude. Additional females were collected during March in a Malaise trap in the Northern Province and in the Uva Province near streams sheltered by trees at an altitude of 250 m.

Aedes (Verrallina) yerburyi EDWARDS
(Figs. 10, 18, 23, 27-29)

- Aedes (Aedes) yerburyi* Edwards 1917: 222 (♂*); of Edwards 1932: 177; Edwards in Barraud 1934: 279, 293 (♂*, key); Carter 1950: 89; Wijesundara 1951: 174, 177, 178, (♀*, keys); Menon 1954: 141 (key); Qutubuddin 1960a: 138.
- Aedes yerburyi* of Brunetti 1920: 145; Edwards 1922a: 265 (key); Senior-White 1923: 55, 1927: 62.
- Aedes (Aedes) yerburyi* of Edwards 1922b: 468; Chow et al. 1954: 118; Horsfall 1955: 530; Stone et al. 1959: 209; Knight and Stone 1977: 72.
- Aedes (Neomacleaya) yerburyi* of Stone and Delfinado 1973: 305; Harrison et al. 1974: 153.
- Aedes (Verrallina) yerburyi* of Reinert 1974b: 17, 95 (♀*, ♂*), 1978: 229 (P*, L*); Knight 1978: 15, 38.

FEMALE. Head. Antenna dark brown, 0.94-1.09 length of proboscis; pedicel dark brown with a few short dark setae and small broad blackish-brown scales mesally, flagellomere 1 with basal 0.5 golden and with a few small broad blackish-brown scales; clypeus dark brown; maxillary palpus blackish-brown scaled, 0.16-0.19 length of proboscis; proboscis blackish-brown scaled, 1.02-1.13 length of femur I; eyes separated in front; vertex with broad blackish-brown decumbent scales except for a few broad white decumbent scales on posterior area and extending onto occiput, a few narrow curved white scales along coronal suture and on interocular space, a patch of broad white scales on postgena extending from area in front of anteprototum to ocular suture; several dark brown ocular and interocular setae; occiput with a number of brown moderately long erect forked scales, a few similar erect scales on posterior area of vertex. **Thorax.** Scutal integument dark reddish-brown; scutum covered with narrow curved dark reddish-brown scales except for narrow curved white scales on following areas, a small patch on anterior promontory, a small patch on anterior scutal fossal, and a small patch on supraalar, prescutellar area bare except for a narrow median stripe of narrow curved reddish-brown scales; short reddish-brown setae on following areas: 4-6 on anterior promontory, scutal fossal (3-8 anterior, 3-7 lateral, 1, 2 median and 1, 2 posterior), numerous acrostichal (anterior and posterior), numerous dorsocentral (anterior and posterior), several on lateral margins of prescutellar area, numerous antealar, and 4 posterior medial scutal; scutellum with a patch of narrow curved reddish-brown scales on each lobe, dark reddish-brown setae on following, 9-14 on lateral lobe and 10-16 on median lobe; pleural integument moderately to dark brown; anteprototum without scales, 14-19 dark setae; postprototum with a dorsal patch of narrow curved reddish-brown scales and a small ventral patch of broad and 2-4 narrow curved white scales, 5-7 dark posterior setae; proepisternum with a small patch of broad dusty white scales and 12-18 dark and pale setae on upper area; postspiracular area without scales, 3-6 dark and pale setae; mesokatepisternum with a large upper and a small lower patch of broad dusty white scales, 3-6 upper and 8-11 lower dark and pale setae, a few short fine setae on anterior area below subspiracular area; prealar area with 10-16 dark setae; mesepimeron with a large median patch of broad dusty white scales, 10-20 short dark upper setae dorsad of scale patch and 3-5 short fine setae on ventroposterior margin of scale patch; other pleural areas bare. **Legs.** Coxae I-III with several setae, I with broad scales on anterior surface, white ones

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dorsally and brown ones ventrally, II, III with a patch of broad dusty white scales on anterior surfaces; trochanters I-III with several short pale setae, a few broad pale scales; femora I-III dark brown scaled, I with a posterodorsal longitudinal white scaled stripe extending from base to near apex, II, III with an anteroventral and a posteroventral longitudinal white scaled stripe from base to near apex, II, III also with a few white scales on apex of anterior and posterior surfaces but not on dorsal surfaces; tibiae I-III dark brown scaled; tarsi I-III dark brown scaled, II with pale scales on basal 0.5 of tarsomere 1; posttarsi I-III (Fig. 28) with 2 ungues, I, II with ungues equal in size, each with a tooth, III with ungues equal in size, both simple. *Wing.* Dorsal and ventral veins dark brown scaled; alula with a row of dark brown scales on margin; upper calypter with pale setae on margin; 1, 2 dark remigial setae. *Halter.* Pedicel pale; capitellum pale scaled. *Abdomen.* Terga dark blackish-brown scaled, I with a laterobasal patch of white scales, II-VII with a large laterobasal white scaled patch which curves posterodorsally and extends onto lateral surface of dorsum; a few specimens with a few white scales dorsally between lateral white patches; sterna II-VII white scaled with posterior area brown scaled. *Genitalia* (Fig. 10). Very large in undissected specimens; tergum VIII with numerous broad scales covering apical 0.64-0.73, basal 0.2-0.4 retracted into segment VII, heavily pigmented, broad, apex gently convex, numerous short thin and long stout setae on apical margin, several short setae on apical 0.34-0.51, basolateral seta absent, VIII-Te index 0.38-0.47, VIII-Te/IX-Te index 1.05-1.33, length 0.32-0.35 mm, width 0.67-0.86 mm; sternum VIII with numerous broad scales on most of area covered by setae, heavily pigmented, base slightly concave mesally, apex with a small (0.05-0.06 of length) median indentation and with a small lobe on each side of midline, apex moderately sloped from lobe to lateral margin, numerous short and a few moderately long setae on apical margin and over apical 0.92-0.94, basolateral seta minute, VIII-S index 0.57-0.70, length 0.37-0.45 mm, width 0.65-0.76 mm; tergum IX heavily pigmented, very large, apex slightly concave, base strongly concave, setae absent, IX-Te index 0.65-0.83, length 0.26-0.33 mm, width 0.33-0.40 mm; insula unpigmented, short, 3, 4 small tuberculi, each with a minute spicule; lower vaginal lip heavily pigmented, lower vaginal sclerite heavily pigmented, composed of 2 large plates which cover most of lateral areas of lower vaginal wall, apex of sclerite bluntly curved mesad; upper vaginal lip heavily pigmented, posterior margin rounded and caudally projected into a large shield which extends over much of postgenital lobe (in slide mounted specimens), median lateral margin of lip produced into a large bluntly rounded wing-like structure, upper vaginal sclerite heavily pigmented, large and complex, extended over nearly all of upper vaginal wall; spermathecal eminence heavily pigmented, very large, very long and narrow, numerous short spermathecal eminence spicules along entire length of lateral margins, spicules mostly simple but some branched; postgenital lobe short to moderately long, moderately broad, apex with a very deep (0.50-0.58 of dorsal length) median indentation, 14-29 setae on each side of midline, 31-57 total setae, dorsal PGL index 0.83-0.90, ventral PGL index 1.07-1.25, ventral length 0.12-0.16 mm; cercus with broad scales few to absent on dorsal surface, more or less triangular, moderately long and moderately broad at base, dorsal surface with numerous short and moderately long setae on apical 0.86-0.95, 2, 3 long stout setae at apex, ventral surface with several short setae along lateral margin and on median area, cercus index 2.98-4.23, cercus/dorsal PGL index 3.20-4.00, length 0.33-0.38 mm, width 0.09-0.13 mm; 3 sper-

mathecal capsules, 1 large, 1 medium and 1 small, heavily pigmented, oblong.

MALE. Essentially as in the female but with the following differences.

Head. Antenna plumose with setae directed mainly dorsal-ventrally, 0.91-0.99 length of proboscis; maxillary palpus 0.13-0.14 length of proboscis; proboscis 1.08-1.17 length of femur I; vertex with fewer narrow curved white scales along coronal suture. *Thorax.* Setal differences as follows: 5, 6 anterior promontory, scutal fossal (5, 6 anterior, 4-6 lateral, no median, and 2, 3 posterior), scutellar (5-8 on lateral lobe and 7-12 on median lobe), 10, 11 anteprenotal, 4-6 postprenotal, 10-14 upper proepisternal, 4, 5 postspiracular, 8-14 prealar, and 9, 10 upper mesepimeral. *Legs.* Posttarsi I-III (Fig. 29) with 2 ungues, I, II with ungues unequal in size, larger one with a tooth, III with ungues equal in size, both simple. *Abdomen.* Tergum VIII with posterior 0.5-0.7 white scaled. *Genitalia* (Fig. 18). Tergum IX moderately to heavily pigmented (areas basad of paraprocts heavily pigmented), cephalic margin concave, caudal margin fused to tergum X, broadly connected laterally to sternum IX; gonocoxite with a very small pointed knob lateroapically bearing 2, 3 short setae, mesoapically with a large laterally curved hook-like structure, dorsal surface of gonocoxite with a few short thin, moderately long and long stout setae on apical 0.40-0.45, a few short and long setae on lateral and outer ventral surfaces, several broad scales on outer dorsal, lateral and ventral surfaces; gonostylus moderately pigmented, short, moderately broad, 3-6 moderately long thin setae near middle, apex extended into a heavily pigmented blunt point; basal mesal lobe composed of a heavily pigmented, long, narrow, mesal arm with 1, 2 slight bends in apical portion, some specimens with a few small elongate scars on apical 0.3, and a long, fleshy, sternolateral lobe located on mesal membrane dorsad of gonocoxite ventromesal surface, distal 0.4 free and with apex curved, numerous short fine setae along entire length, a lightly pigmented moderately large, flat lobe tergobasad of long mesal arm, extended onto mesal membrane of gonocoxite and bears numerous short fine setae; proctiger with paraproct formed into a heavily pigmented, long, slender arm, a slight subapical bend in arm, apex bluntly pointed, cercus long (longer than paraproct); phallosome complex, opisthophallus--composed of a lightly pigmented narrow transverse bridge between basal pieces, caudal margin nearly straight, cephalic margin deeply emarginate, sternobasal area attached to tergobasal portion of outer area of prosophallus, phallus--composed of a pair of moderately long, acuminate aedeagal sclerites, apex of phallus formed into a small U-shaped penis filament, prosophallus--composed of a pair of moderately long, acuminate prosophallic sclerites, proximal portion attached to tergomesal portion of paramere, paramere--approximately 0.65 length of phallic sclerite, appears to be articulated at a point on the apex of basal piece, basal piece--heavily pigmented, short; sternum IX with caudal margin concave with a small median lobe which bears 2, 3 short setae.

PUPA (Fig. 23). Chaetotaxy as figured and recorded in Table 5.

Cephalothorax. Moderately to heavily pigmented; lateralialia with well developed cuticular ocular facets of the compound eye; seta 5-CT with 5-8 branches.

Trumpet. Moderately to heavily pigmented; index 3.51-4.13, mean 3.87.

Abdomen. Terga I-VI (occasionally VII) with dorsobasal areas moderately to heavily pigmented and with a few circular pale areas on median basal areas; seta 1-II with 7-22 branches; 2-II mesad or even with 3-II; 1-III with 5-13 branches; 5-IV with 2-6 (usually 3-6) branches; 1-V with 3-6 (usually 4, 5) branches; 1-VI with 3-7 (usually 5-7) branches; 11-VI single to 3 (usually 2, 3) branched; 3-VII with 4-7 branches; 9-VIII single or 2 branched. *Paddle.* Ovoid; well developed serrations on most of basal 0.79-0.82 of outer margin; minute

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spicules on apical 0.18-0.21 of outer and apical 0.11-0.20 of inner margins; seta 1-P single; index 1.40-1.58, mean 1.49.

LARVA (Fig. 27). Chaetotaxy as figured and recorded in Table 9. *Head*. Heavily pigmented with a pattern of lightly pigmented areas, patch of small spicules over compound eye; seta 4-C with 4-8 (usually 4, 5) branches; 5-C with 2-4 (usually 3) branches; 5, 6-C with one branch noticeably longer than other branches; 7-C with 7-11 (usually 8-10) branches; dorsomentum with 36-42 teeth. *Antenna*. Moderately long; moderately pigmented; with a number of small to well developed spicules along entire length; seta 1-A with 4-6 (usually 4, 5) branches, moderately long. *Thorax*. Seta 8-P with 2 branches; 3-M single. *Abdomen*. Seta 6-I with 2 branches; 7-I with 2, 3 (usually 2) branches; 1-II single; 1-III with 2-4 branches; 3-IV with 7-10 branches; 1, 2-VIII attached to a small sclerite; 4-VIII single; comb with 8-10 (usually 10) scales arranged in a single curved row, each scale with a long stout median spine and with short denticles on laterobasal areas; 4 anal papillae, long and narrow, approximately 2.5-3.0 times length of saddle. *Siphon*. Heavily pigmented; index 1.88-2.07, mean 1.94; pecten on basal 0.60-0.64 of siphon, composed of 14-17 (usually 14-16) spines, apical 2, 3 spines longer, usually without denticles and wider spaced than remainder, basal spines long, slender and with 1-4 small stout ventral denticles near base; seta 1-S with 4-6 (usually 4, 5) branches, short, attached on basal 0.68-0.71 of siphon distad of last pecten spine.

TYPE-DATA. The holotype male of *Ae. yerburyi*, deposited in the BMNH, possesses the following data: Kitli Station, Ceylon, 29.xi.1891, and Lt.-Col. Yerbury. Edwards (*in* Barraud 1934: 293) reported that ". . . the type is rather mouldy and denuded and the ornamentation not well shown." Wijesundara (1951: 174) presumed that the type-locality Kitli Station was at Kayts.

DISCUSSION. *Aedes yerburyi* is a member of Series III, Section A of the subgenus. Females have abdominal terga II-VII each with a large laterobasal white scaled patch that curves posterodorsally and extends onto the lateral surface of the dorsum, paratergite and postspiracular areas without scales, postpronotum with 2-4 short fine setae ventrad of the posterior setae, and mesokatepisternum with 3-7 similar fine setae anterior to the upper scale patch.

Female genitalia of *Ae. yerburyi* are easily identified by the very large sternum VIII, shape and very large size of tergum IX, pair of large lower vaginal sclerites, each with apex bluntly curved mesad, upper vaginal lip with bluntly rounded wing-like structures on the median lateral margins, very large spermathecal eminence which is long and narrow with numerous short spermathecal eminence spicules along entire length of lateral margins, and post-genital lobe with a very deep median apical indentation (see Fig. 10).

The male genitalia are also very distinctive and easily separated from all other species of *Verrallina* in the development of the gonocoxite which bears a large, laterally curved, hook-like structure on the mesoapical surface, a very large basal mesal lobe which is divided into a heavily pigmented, long, narrow, mesal arm and a long, fleshy, sternolateral lobe located on the mesal membrane of the gonocoxite, the paraproct which is composed of a pair of heavily pigmented, long, slender arms, and sternum IX with 2, 3 short setae (see Fig. 18).

Pupae of *Ae. yerburyi* show similarities to those of other species of the subgenus, but are distinguished by the following features: trumpet index 3.51-4.13; pigmentation of cephalothorax and abdominal terga; seta 5-CT with

5-8 branches; 1-III with 5-13 branches; 1-V with 3-6 branches; 11-VI usually 2, 3 branched; 3-VII with 4-7 branches; and paddle with heavy serrations on outer margin.

Larvae of *Ae. yerburyi* can be separated from those of other species of the subgenus by the following combination of features: head capsule broad, darkly pigmented and with patterns of lightly pigmented circular areas; a patch of small spicules on compound eye area; seta 5-C with 2-4 (usually 3) branches; 5, 6-C each with one branch noticeably longer than others; 1-A with 4-6 branches; 8-P, 6-I each with 2 branches; 7-I with 2, 3 branches; 1-II, 4-VIII each single; 1-III with 2-4 branches; 3-IV with 7-10 branches; 1, 2-VIII attached to a common plate; and 14-17 pecten spines.

No pupal or larval specimens of *Ae. yerburyi* were available from Sri Lanka, therefore, descriptions and illustrations of these stages are based on specimens from India.

DISTRIBUTION. Twenty-one specimens from Sri Lanka examined: 15♀ and 6♂.

SRI LANKA. *North Central*, Anuradhapura Dist., Padaviya, Irrigation bungalow, 27 February-9 March 1970, D. R. Davis and W. H. Rowe, 1♂; *Northern*, Vavuniya Dist., Parayanalankulam, Irrigation canal 25 mi NW of Medawachchiya, 20-25 March 1970, D. R. Davis and W. H. Rowe, 8♀, 2♂, Matiyamadu, 26 mi SW of Mullaittivu, 14 February 1962, Per Brinck, Hugo Andersson and Lennart Cederholm, 1♀, 1♂, Pali Aru, 20 mi NE of Mannar, 15 February 1962, 2♀, *Western*, Kulinjadiya, Negombo, 17 January 1947, Medical Entomologist of Ceylon, 1♀, 1♂, Yongammulla, 3 mi E of Yakkala and 18 mi NE of Colombo, 24 January-25 March 1962, Per Brinck, Hugo Andersson and Lennart Cederholm, 1♀; Province not specified, Mantivu, December 1931, Medical Entomologist of Ceylon, 1♀, 1♂, Ratmalana, 1 October 1950, 1♀.

Specimens examined from other countries. INDIA.

Distribution from literature.

INDIA. Madras, Nilgiri Hills, Kallar (Reinert 1978: 231).

SRI LANKA (Edwards 1922b: 468, 1932: 177); Kitli Station (Edwards 1917: 222), Trincomali (Edwards in Barraud 1934: 293); Kulinjadiya, Negombo, Mantivu, Ratmalana, Pothuhera (Wijesundara 1951: 174); North Central Prov., Anuradhapura Dist., Padaviya, Northern Prov., Vavuniya Dist., Parayanalankulam, Irrigation canal 25 mi NW Medawachchiya (Harrison et al. 1974: 153; Reinert 1974b: 96).

BIONOMICS. In Sri Lanka, adults were collected during February and March at an altitude of 55 m in North Central Province (Harrison et al. 1974: 153, Reinert 1974b: 96). Wijesundara (1951: 174) reported adults collected from night traps and during the months of January, October, November and December. Females have been collected from dwellings during October in the Western Province. In the Northern Province, adults were taken near a small river in sandy dry scrub-land at an altitude of 3 m and in an indigenous secondary dry forest near a temporary stream (Kankarayan Aru) at an altitude of 70 m.

Immatures of *Ae. yerburyi* were collected in India from fresh, clear, unmoving water in small, temporary ground pools located in arecanut palm plantations during May and August (Reinert 1978: 232).

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30. *Aedes* (*Verrallina*) *butleri*--adult female
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LIST OF FIGURE ABBREVIATIONS

Female Genitalia

AGDB	=	Accessory gland duct base	PGL	=	Postgenital lobe
BLS	=	Basolateral seta	SCa	=	Spermathecal capsule
Ce	=	Cercus	SCaP	=	Spermathecal capsule pore
DPGL	=	Line of attachment of proctiger to dorsal surface of PGL	SE	=	Spermathecal eminence
H	=	Hinge	SES	=	Spermathecal eminence spicule
I	=	Insula	Tu	=	Tuberculus
IX-Te	=	Tergum 9	UVL	=	Upper vaginal lip
LVL	=	Lower vaginal lip	UVS	=	Upper vaginal sclerite
LVS	=	Lower vaginal sclerite	VIII-S	=	Sternum 8
			VIII-Te	=	Tergum 8

Male Genitalia

BML	=	Basal mesal lobe	Par	=	Paramere
BP	=	Basal piece	Ph	=	Phallus
Gc	=	Gonocoxite	PO	=	Prosophallus
Gs	=	Gonostylus	Ppr	=	Paraproct
IX-S	=	Sternum 9	Pr	=	Proctiger
IX-Te	=	Tergum 9	X-Te	=	Tergum 10
OP	=	Opisthophallus			

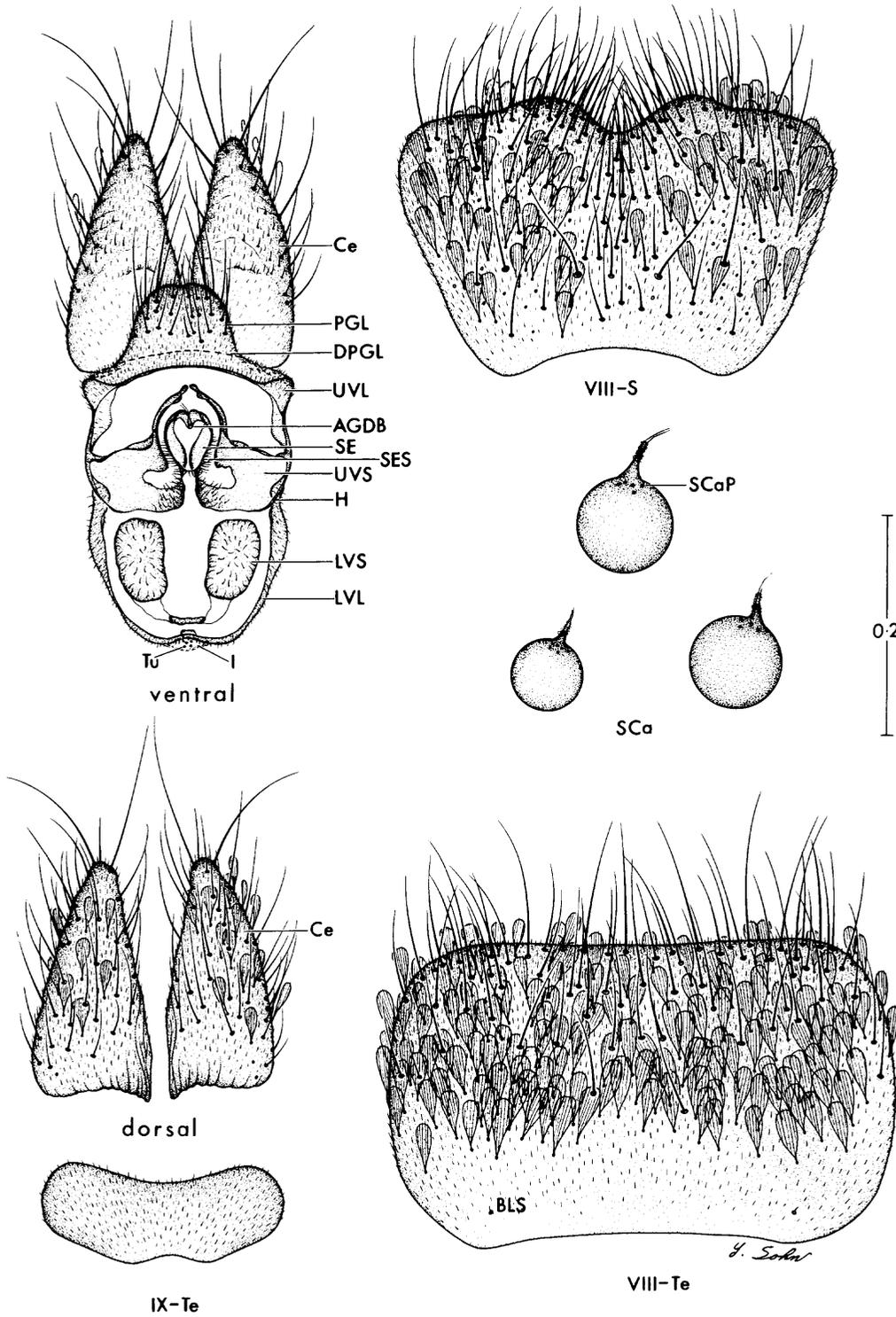
Pupa

CT	=	Cephalothorax	Mtn	=	Metanotum
GL	=	Genital lobe	Pa	=	Paddle
I-VIII	=	Abdominal segments 1-8	T	=	Trumpet

Larva

A	=	Antenna	Mx	=	Maxilla
C	=	Head	P	=	Prothorax
CS	=	Comb scale	PS	=	Pecten spine
Dm	=	Dorsomentum	S	=	Siphon
I-VIII, X	=	Abdominal segments 1-8, 10	T	=	Metathorax
M	=	Mesothorax	VmCS	=	Ventromedian cervical sclerite

Fig.1



butleri

Fig.2

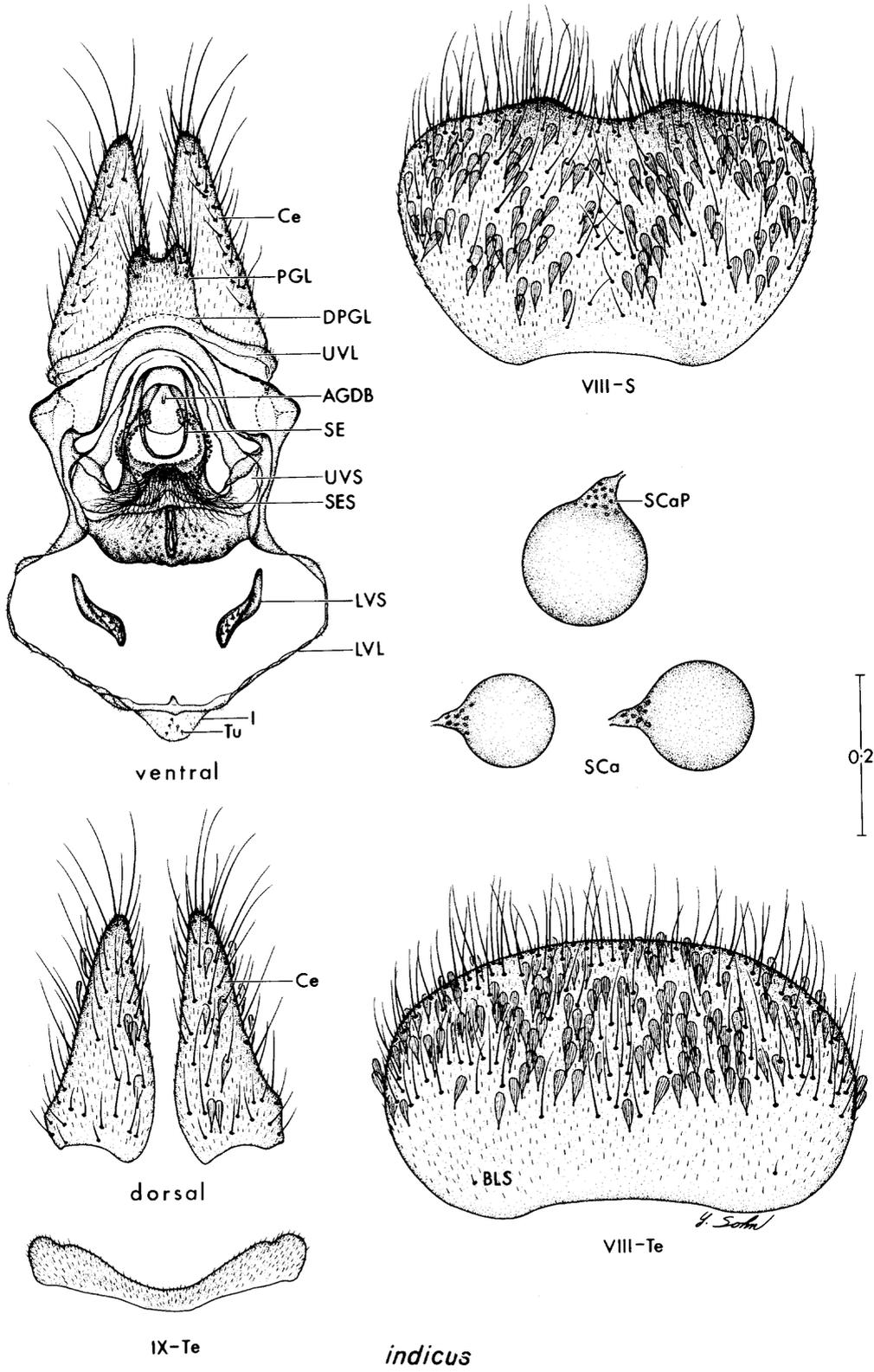
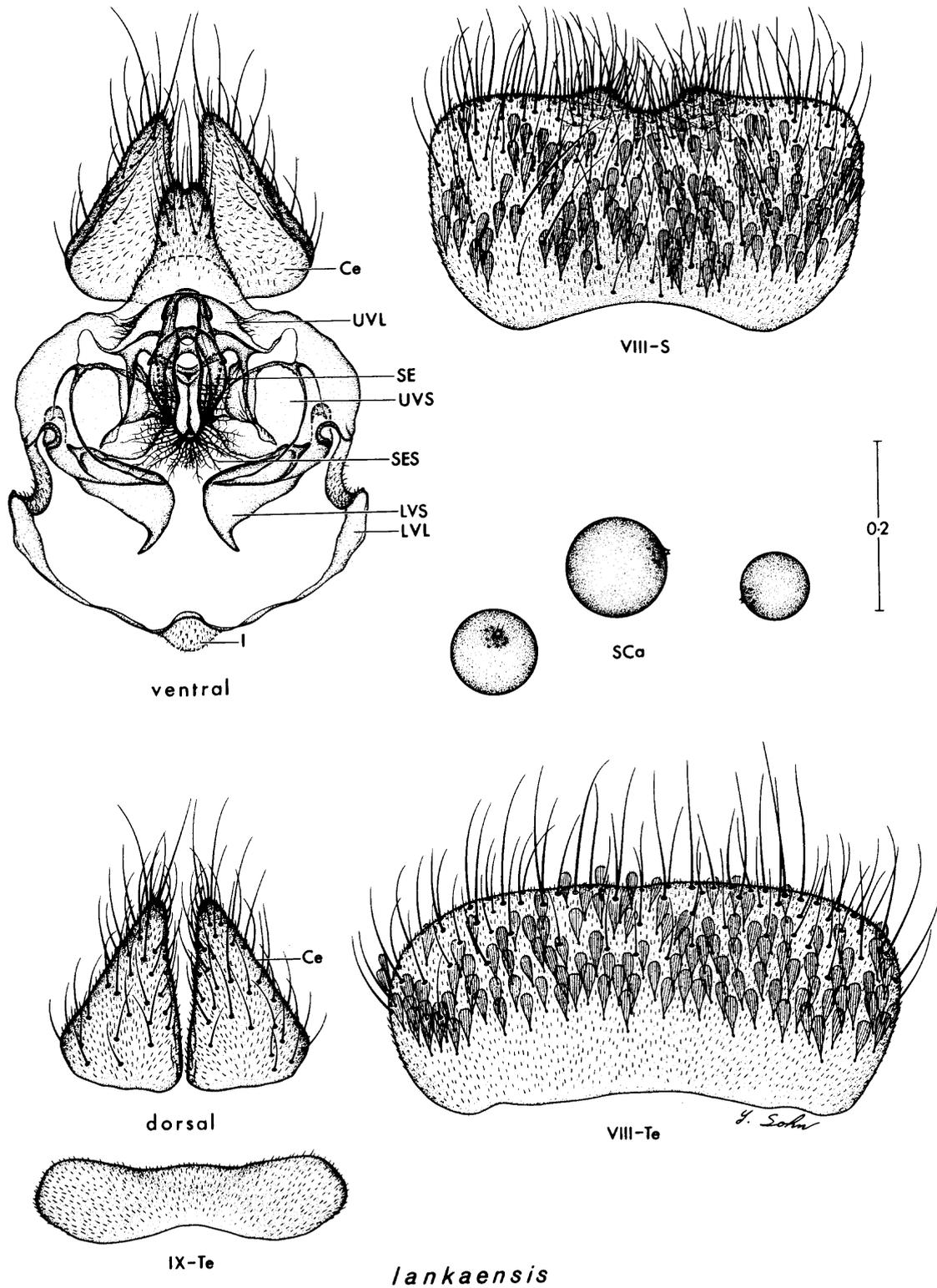


Fig.3



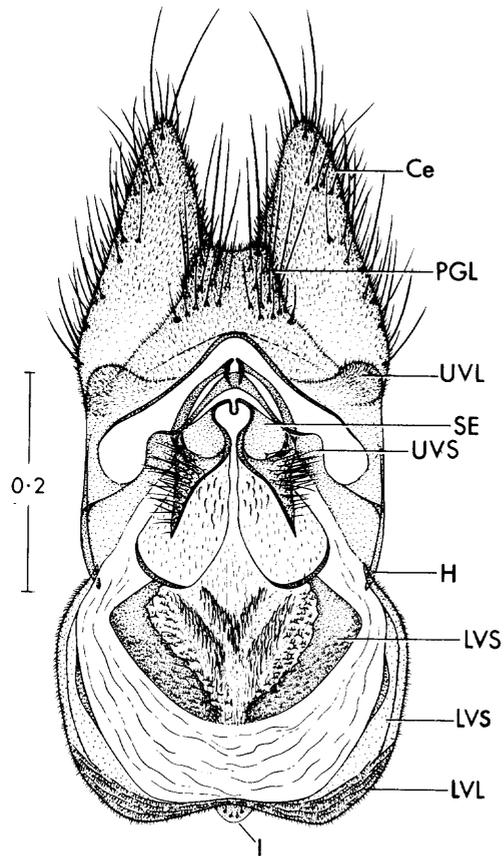
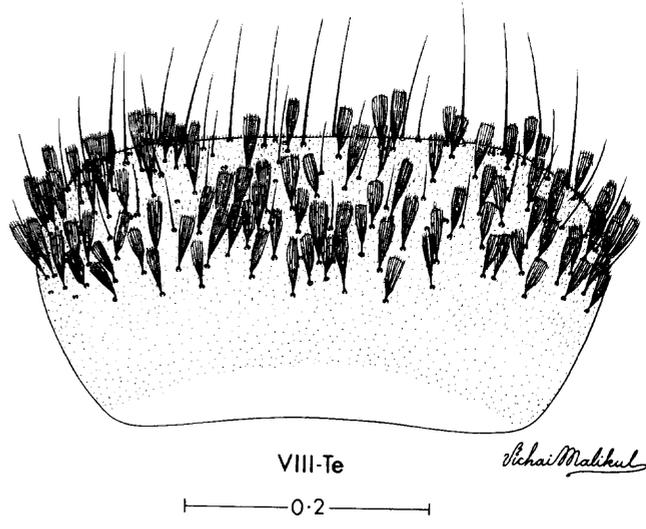
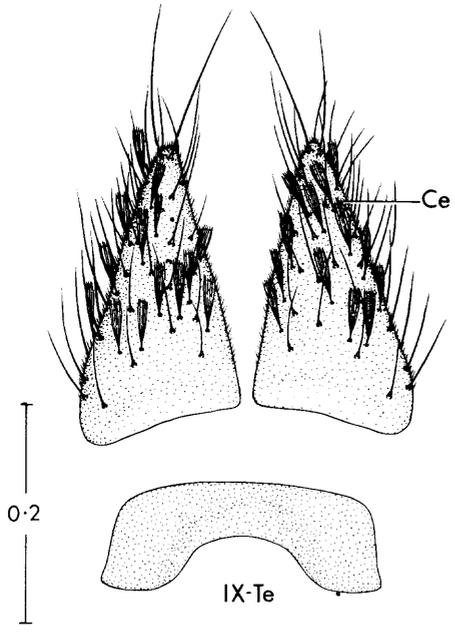
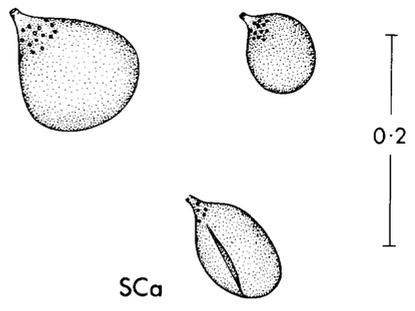
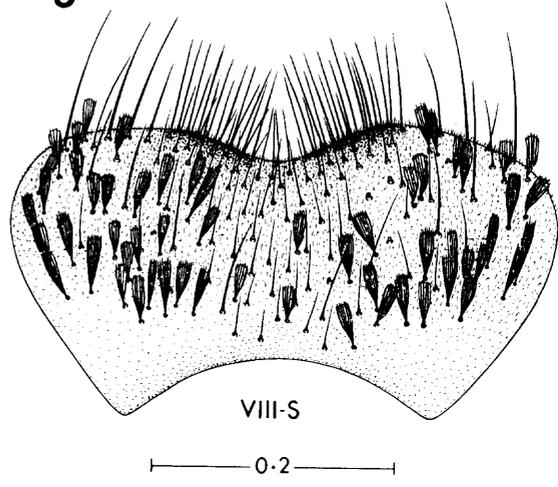


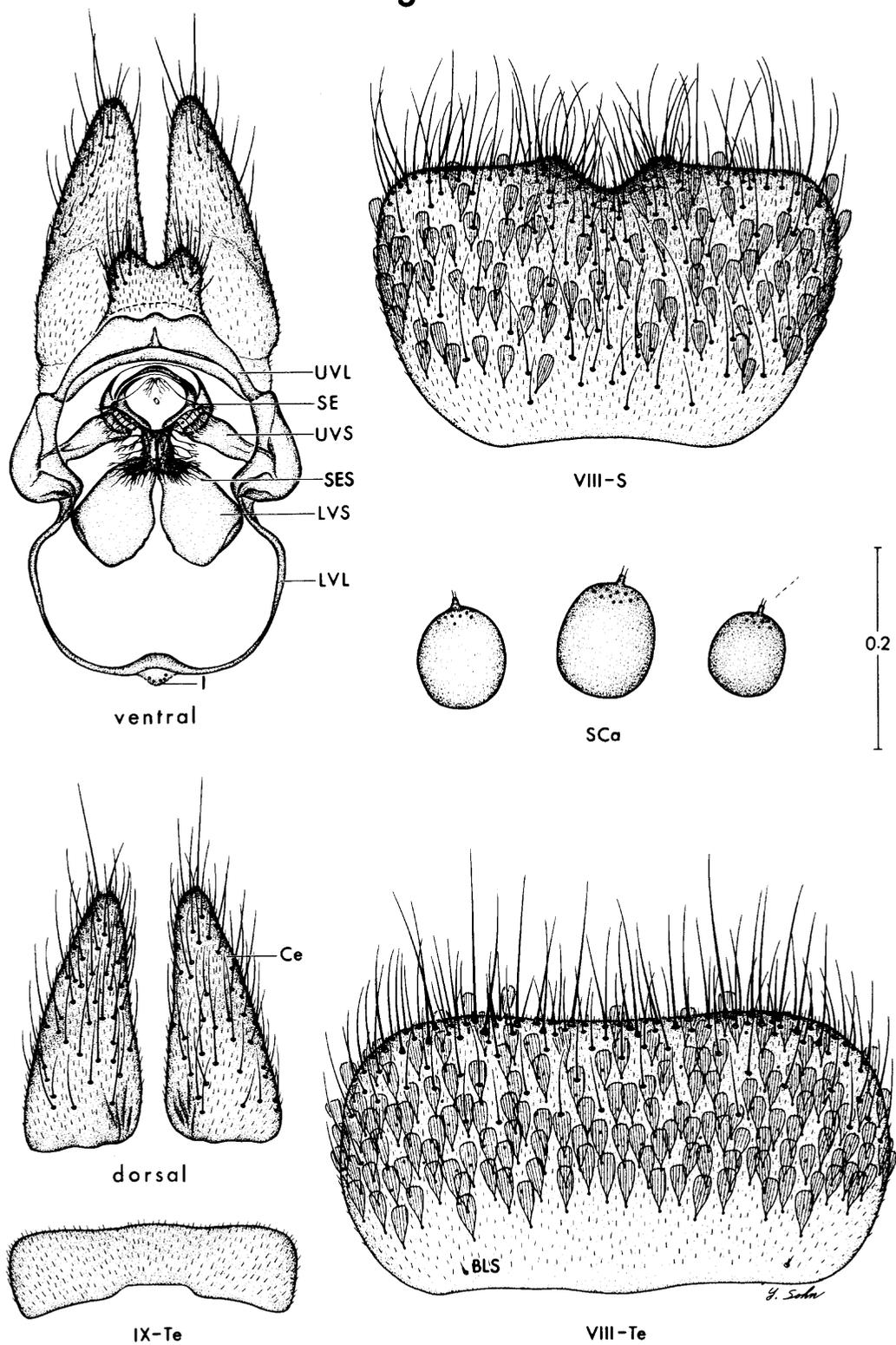
Fig.4



Shehail Malikul

lugubris

Fig.5



petroelephantus

Fig.6

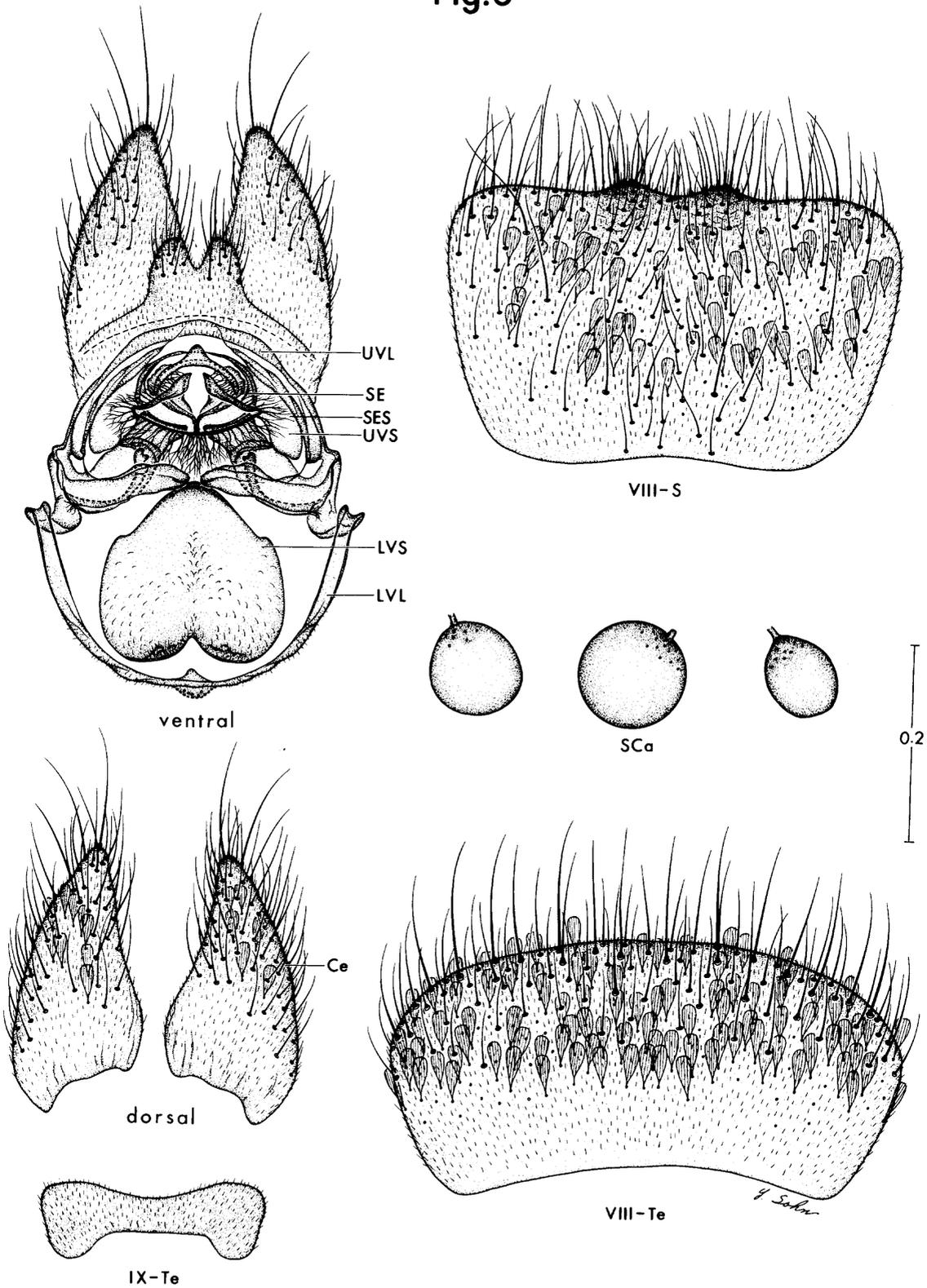
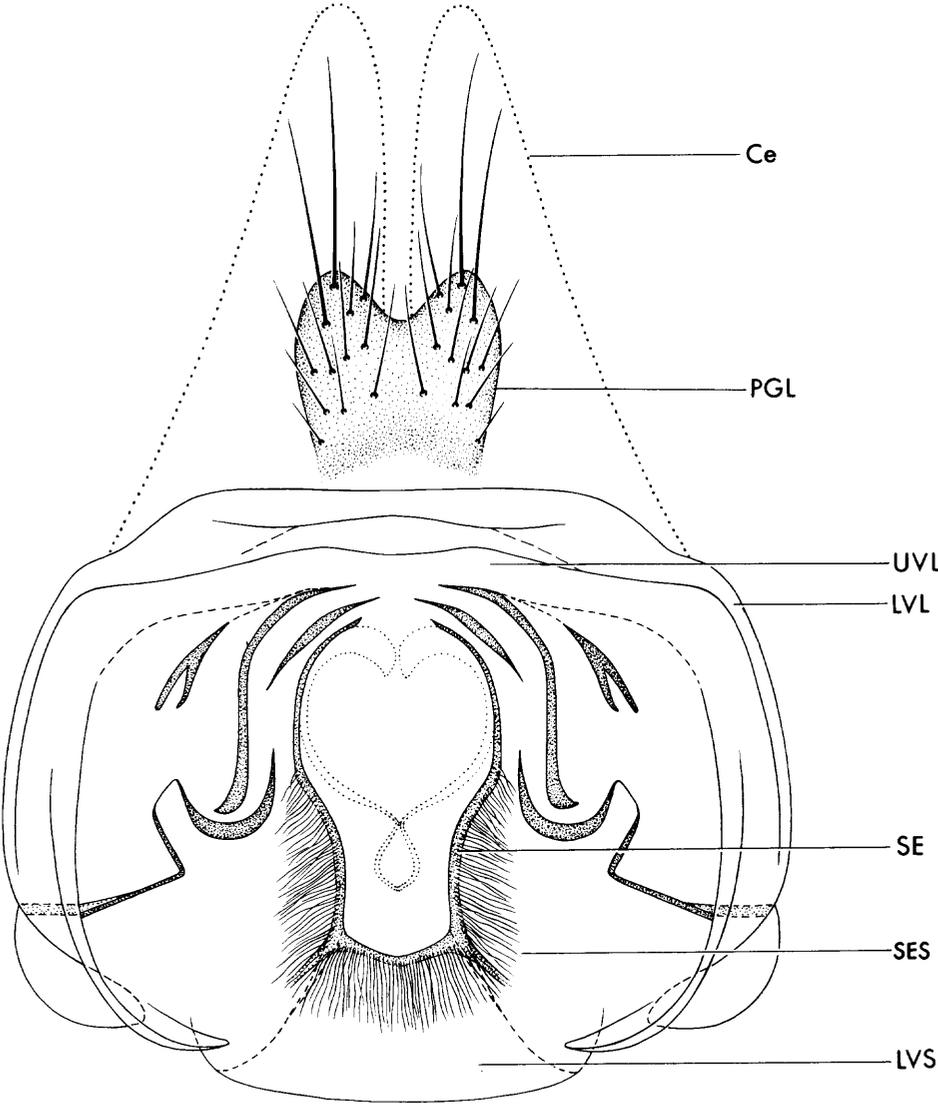
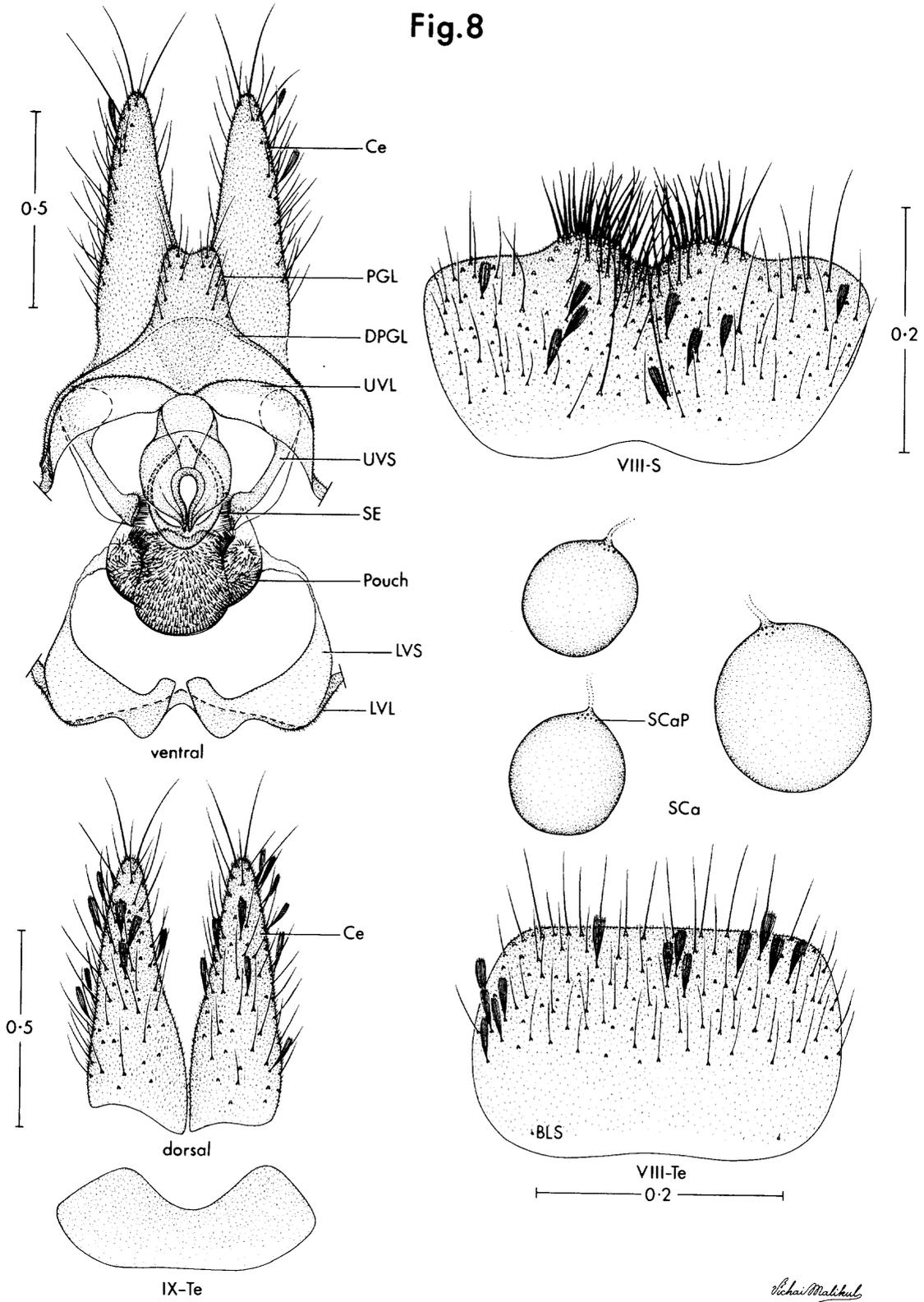


Fig.7



spermatheca
(Drawn from Wijesundara 1951)

Fig.8



srilankensis

Hehai Malikul

Fig.9

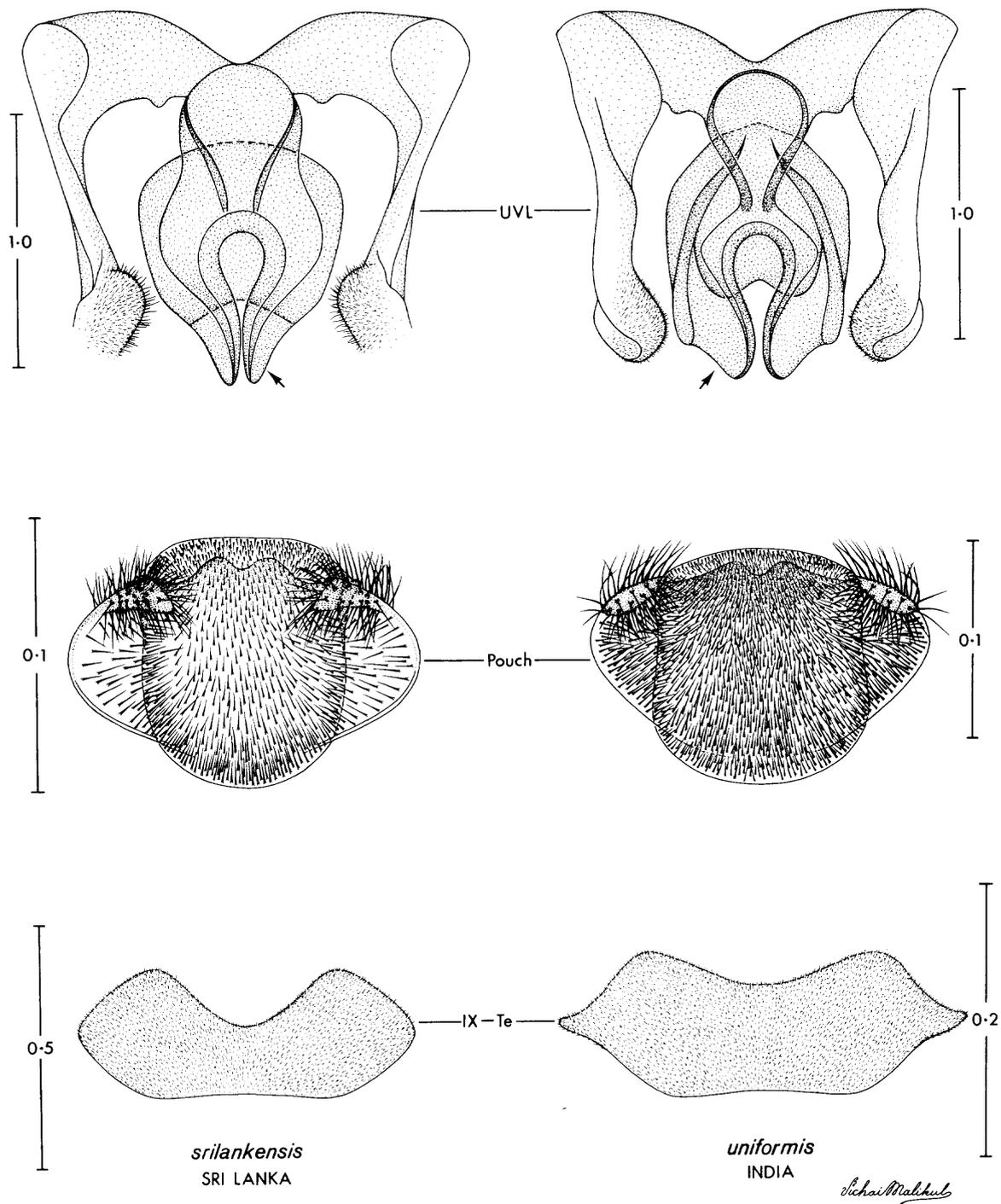


Fig.10

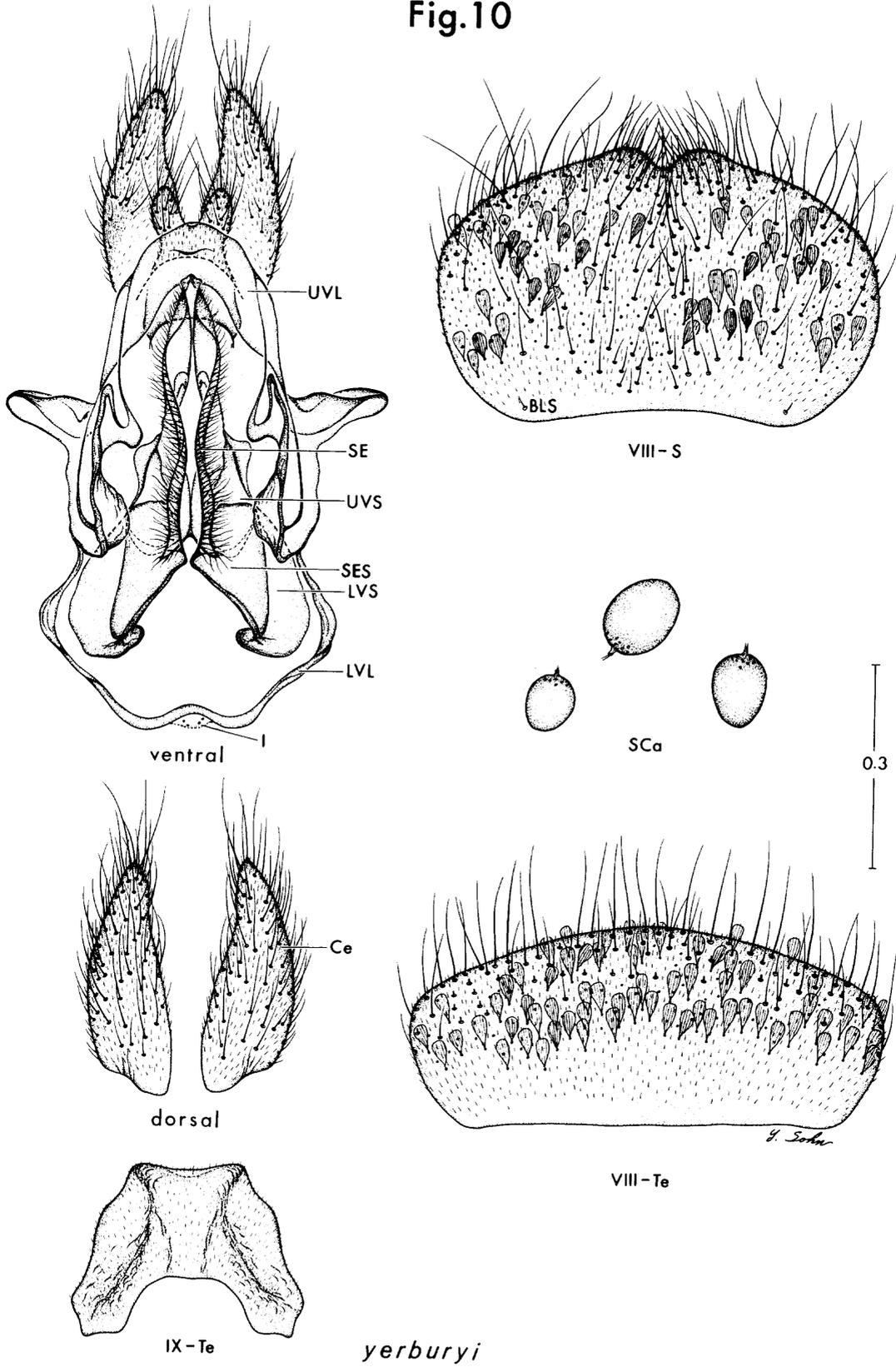


Fig.11

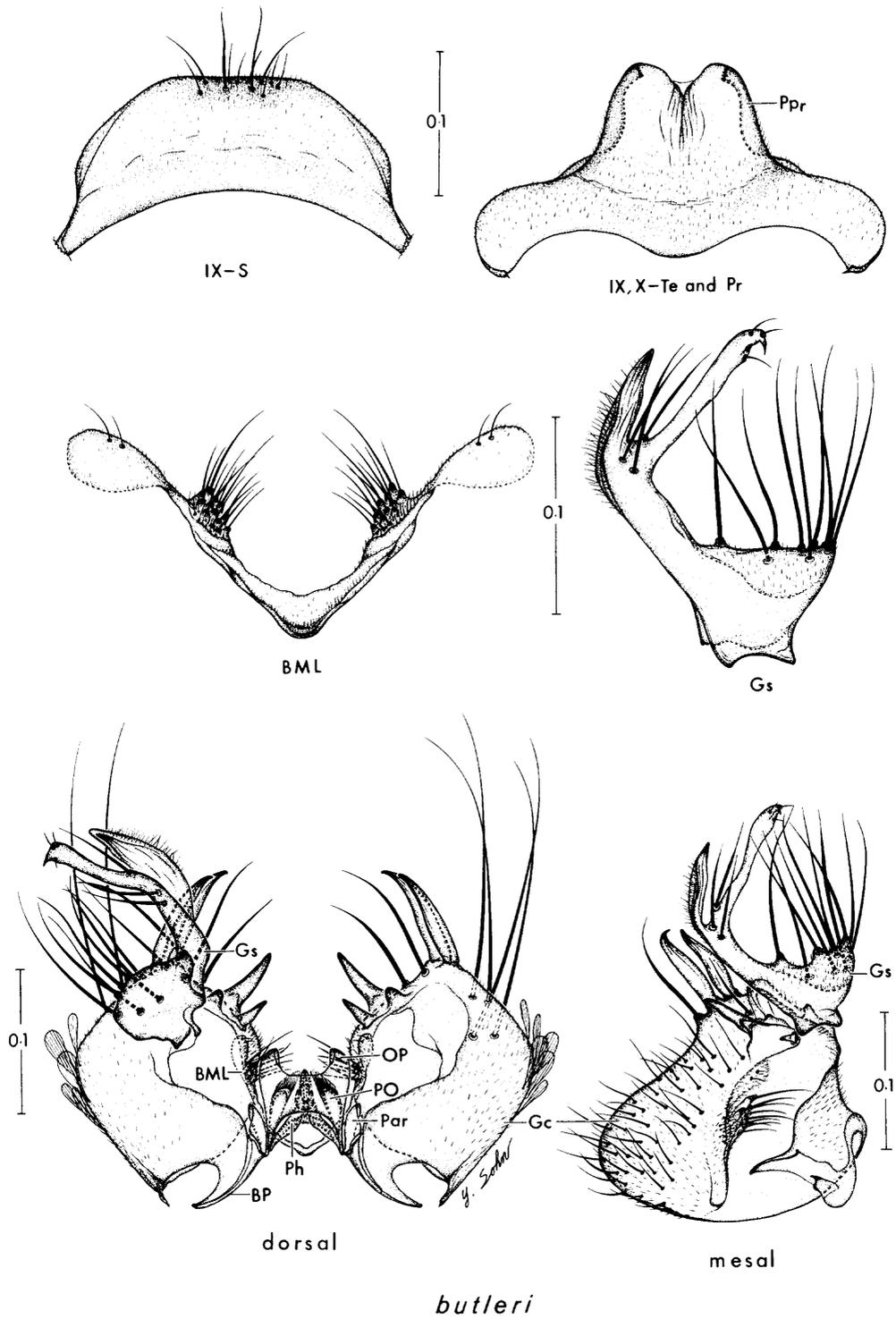


Fig.12

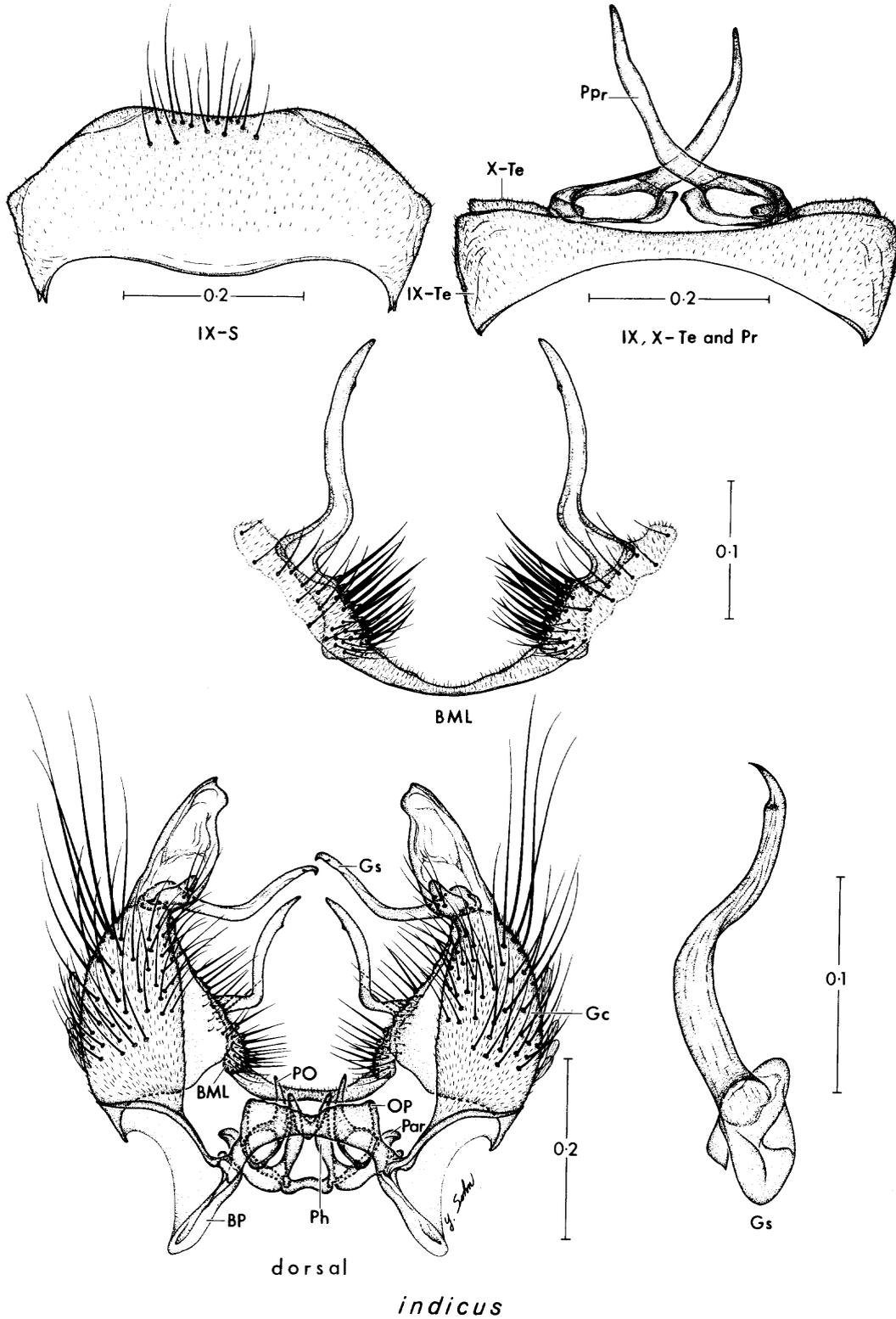


Fig.13

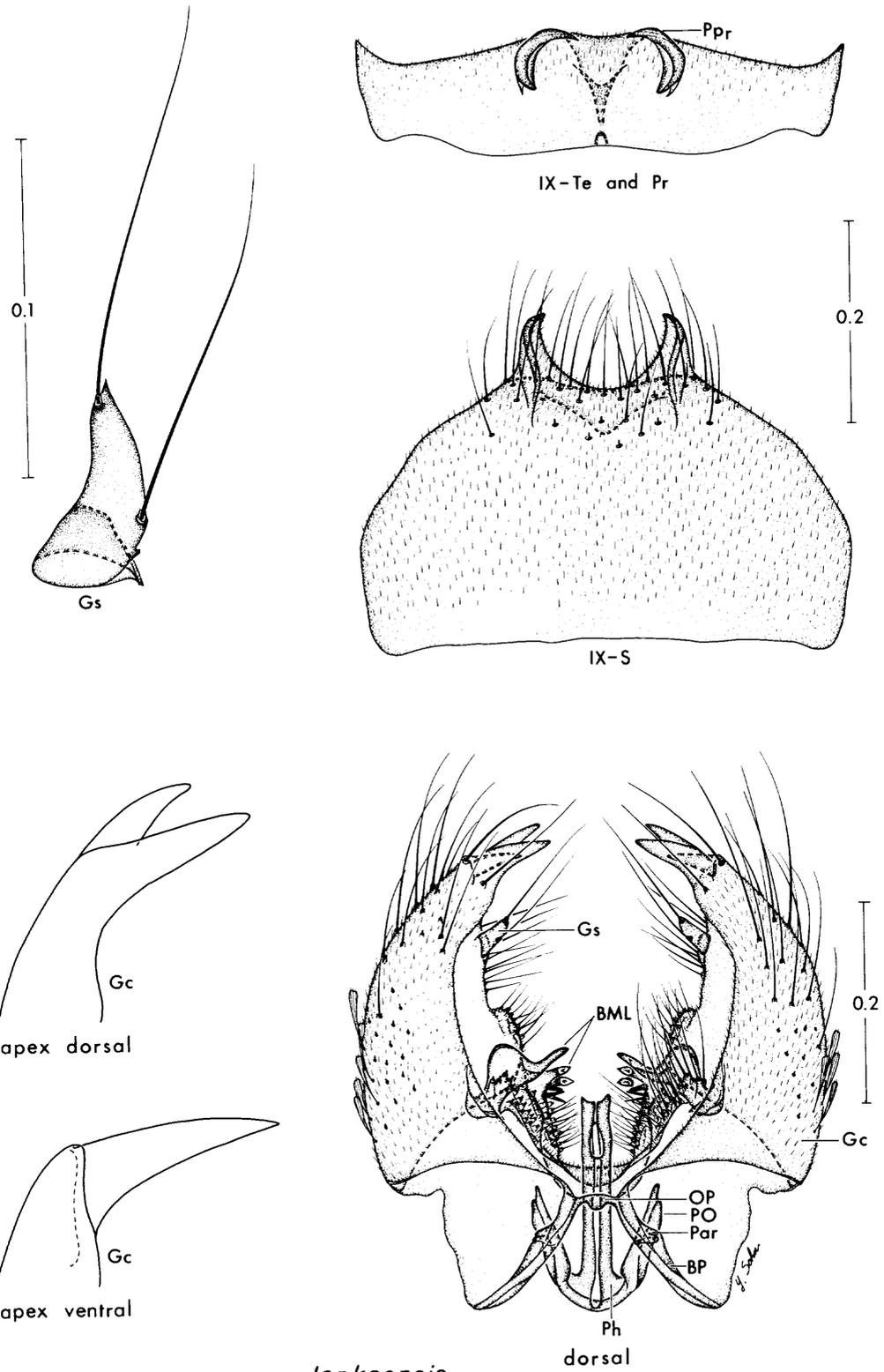
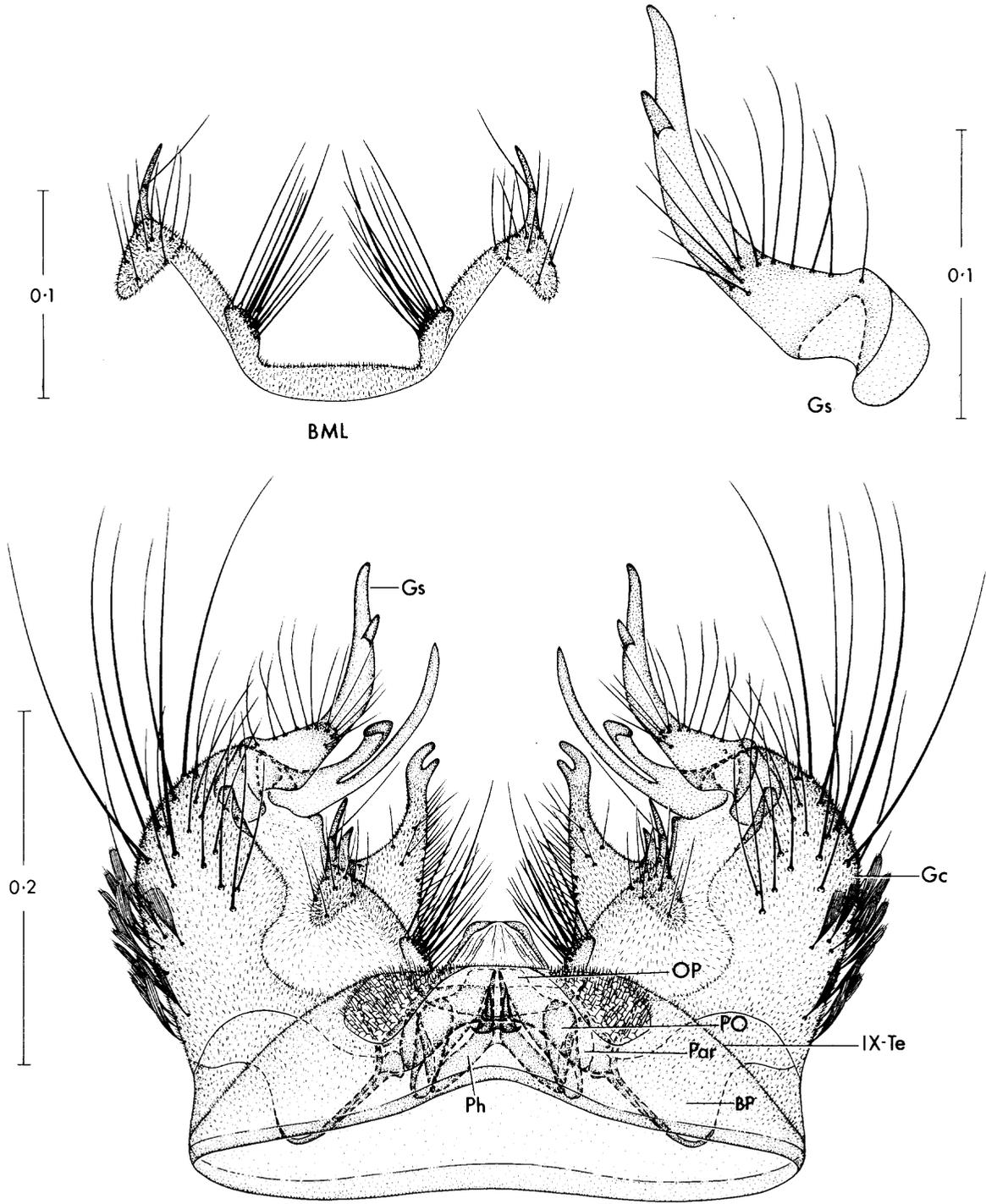


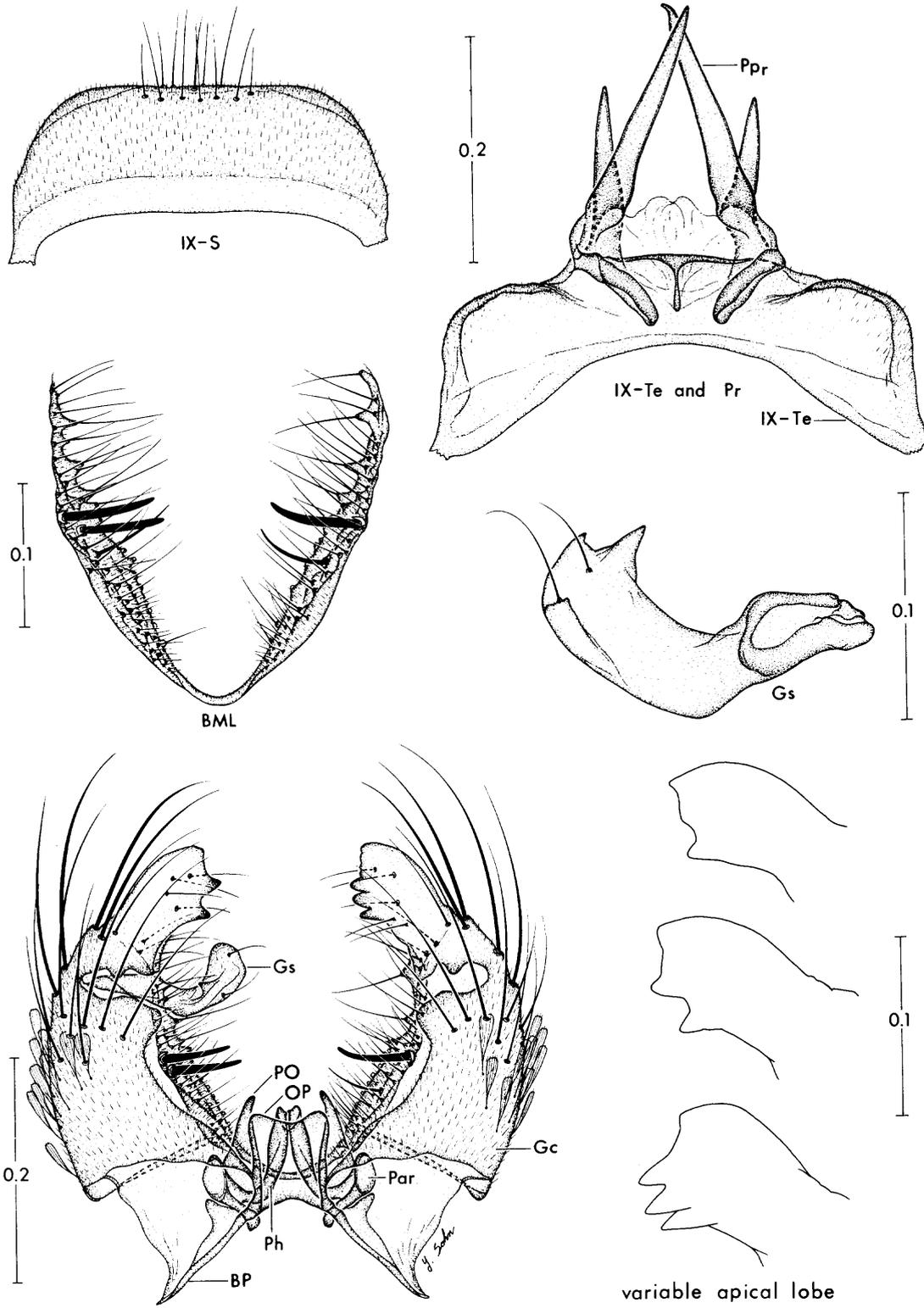
Fig.14



Sichai Malikul

lugubris

Fig.15



pseudomediofasciatus

Fig.16

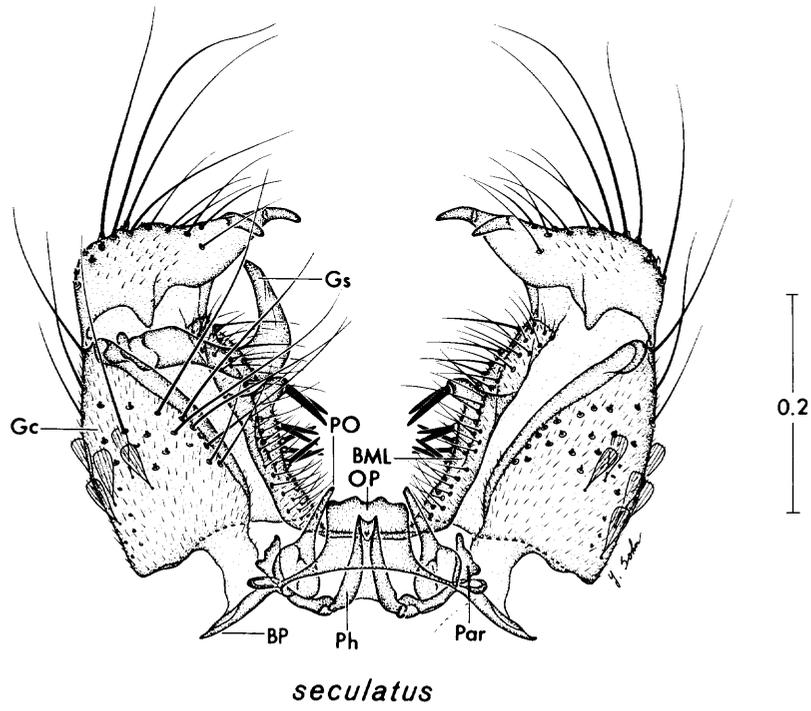
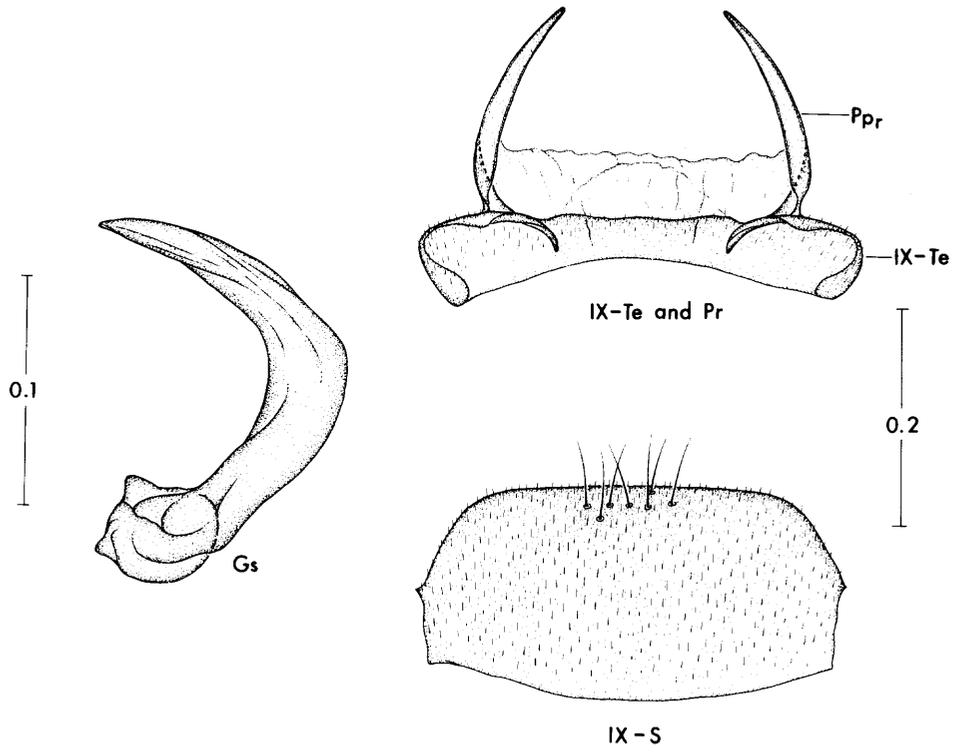


Fig.17

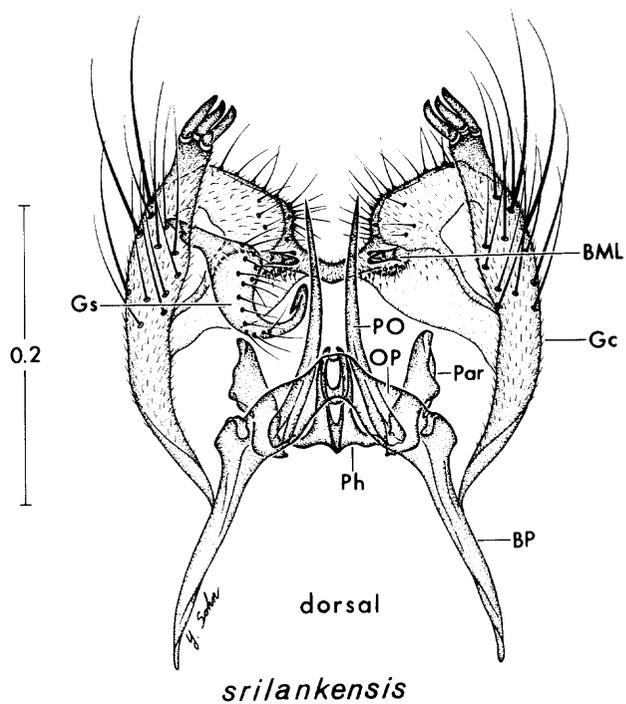
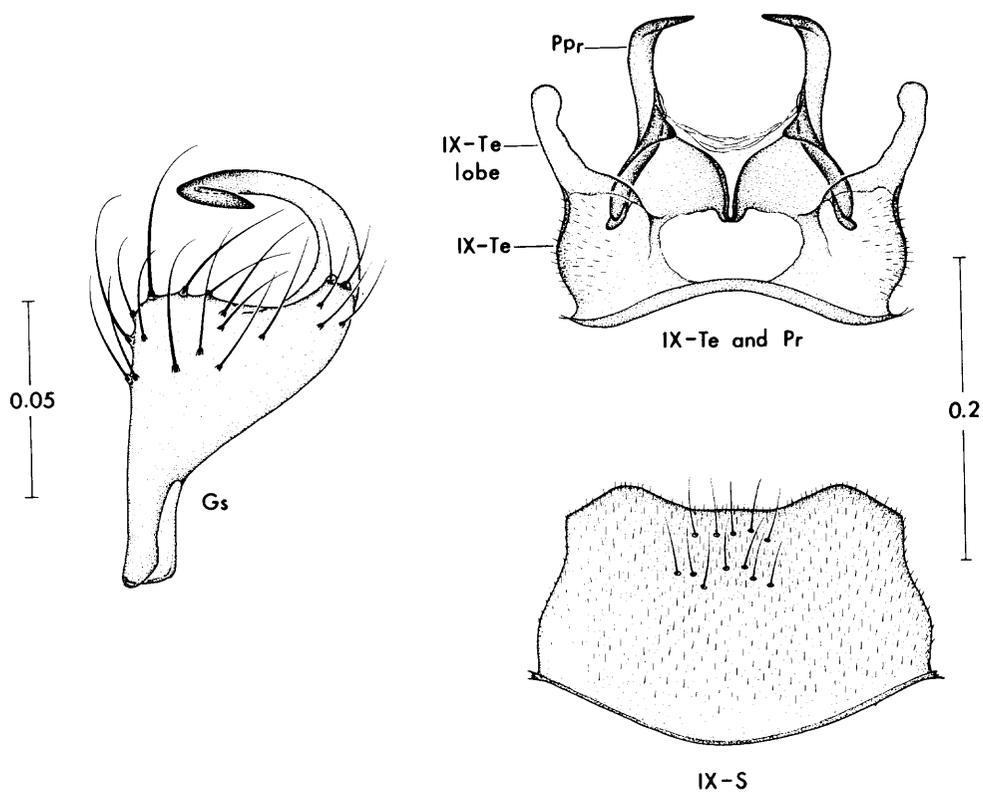


Fig.18

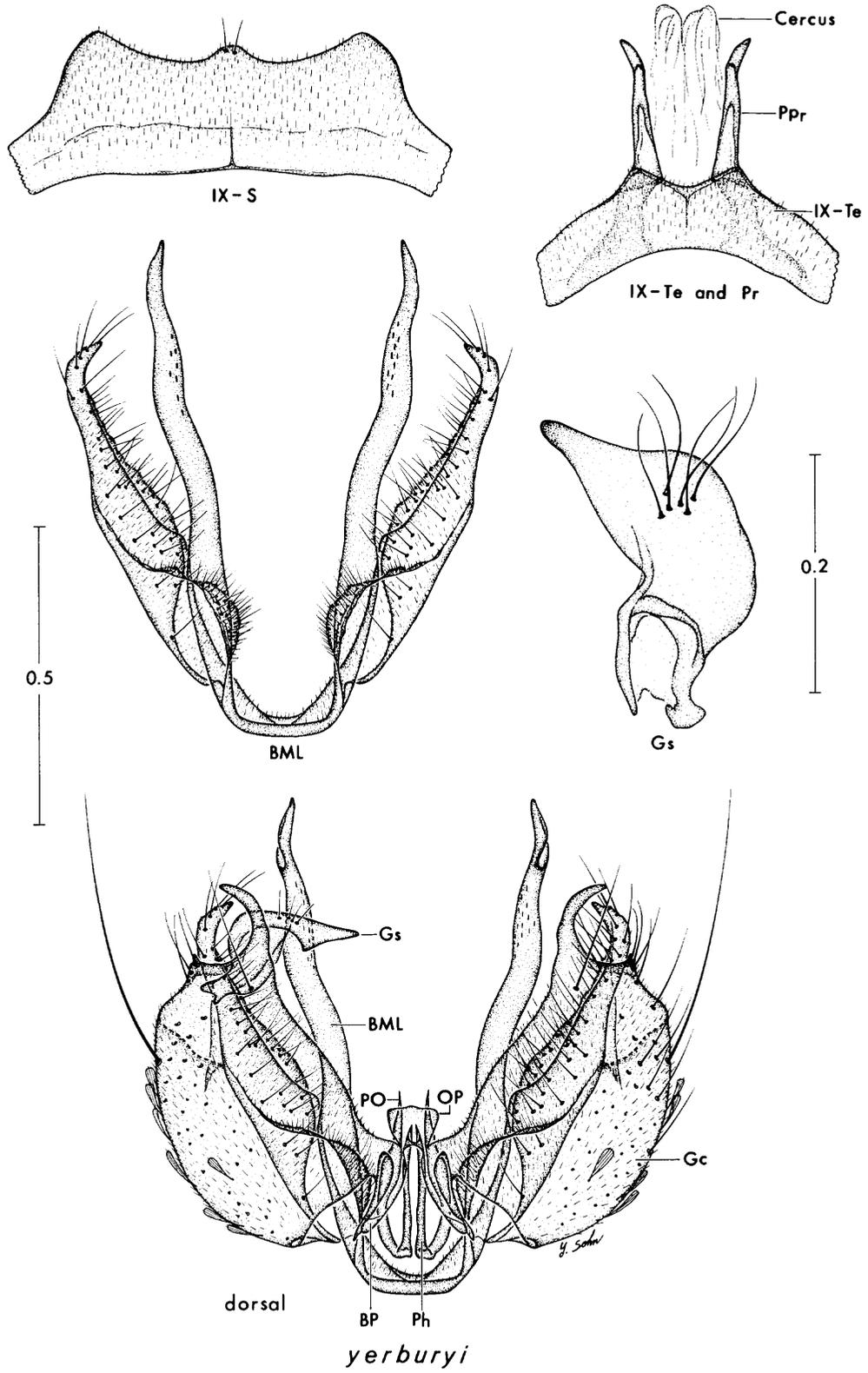
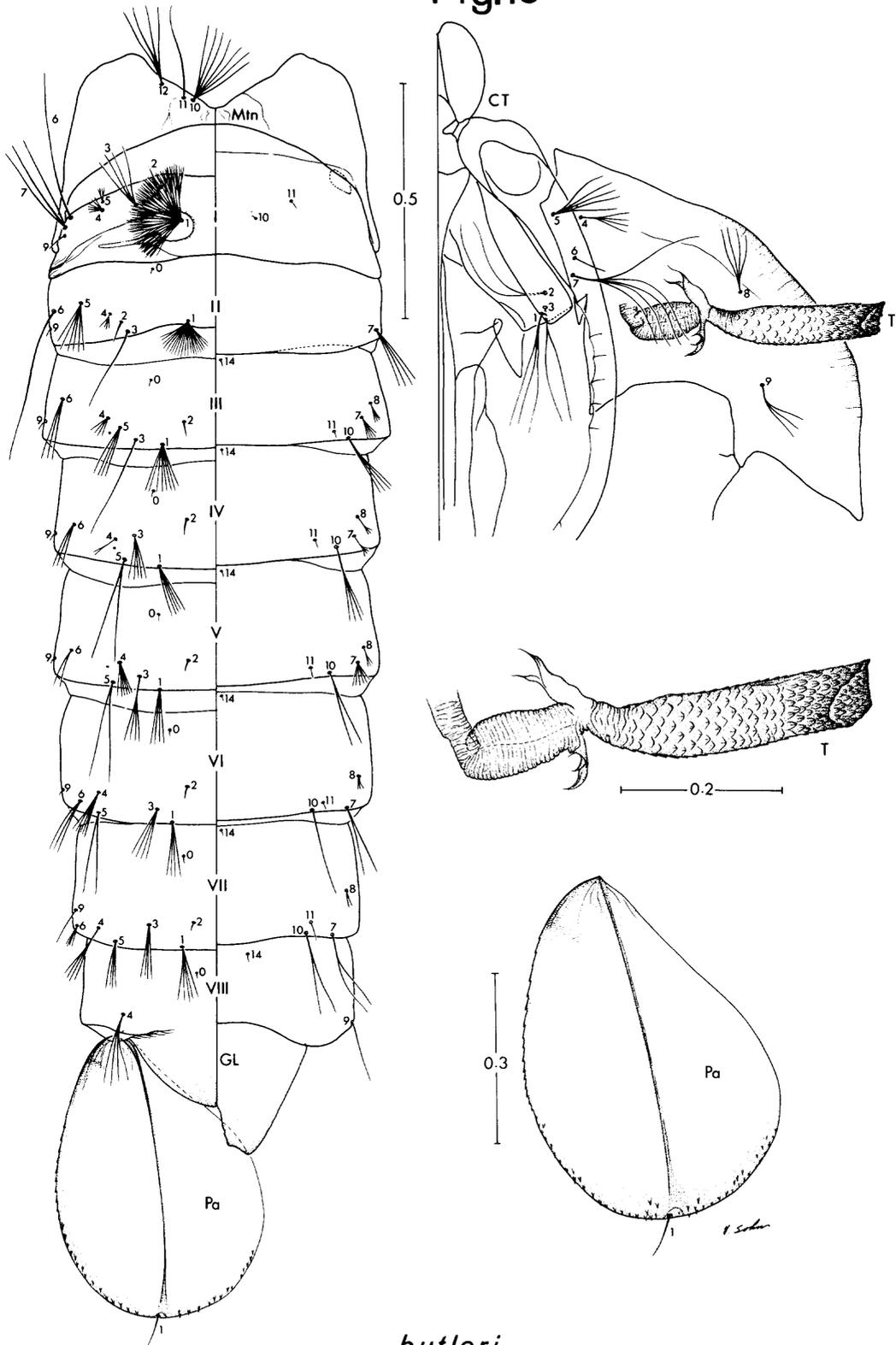
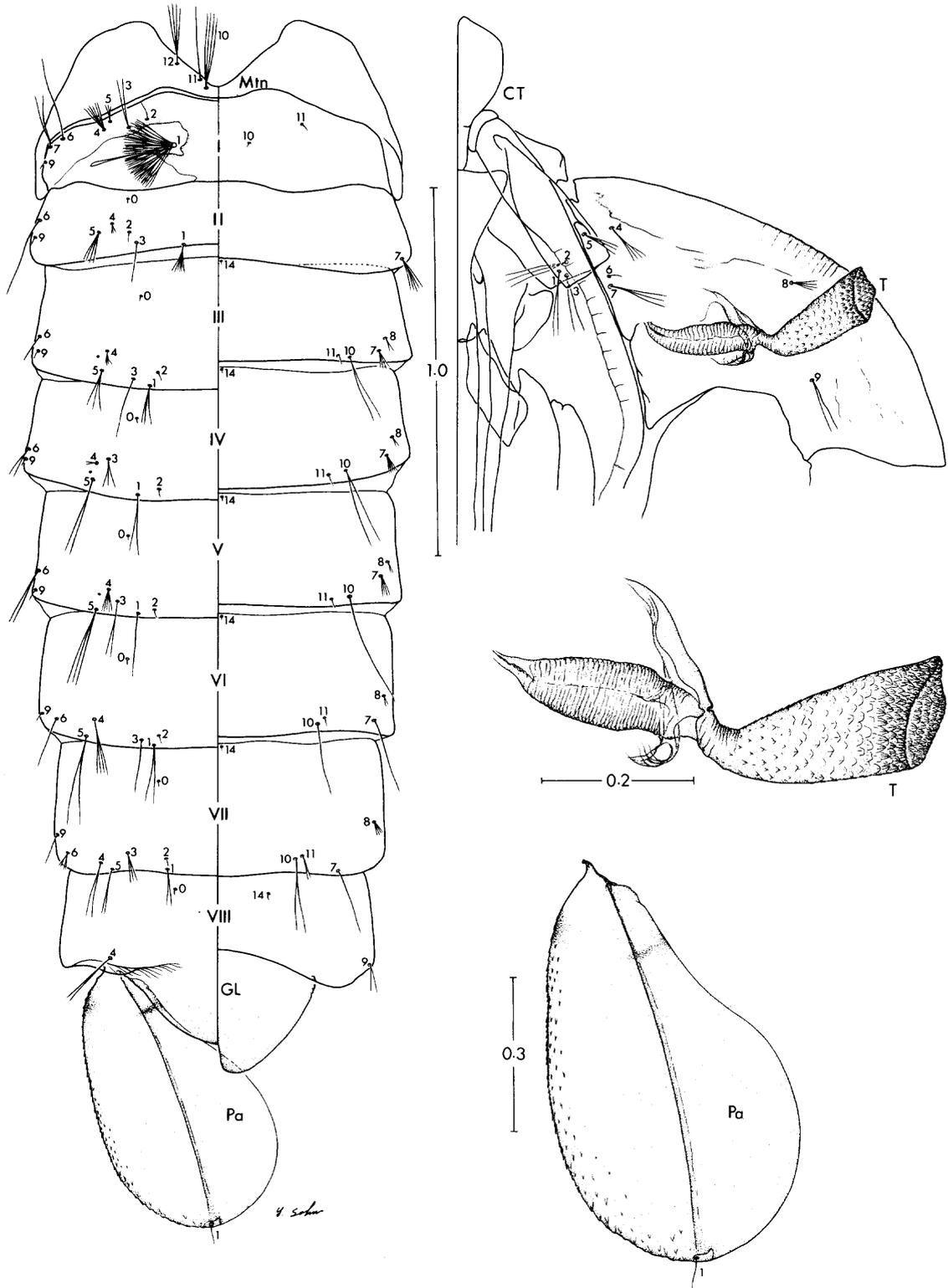


Fig.19



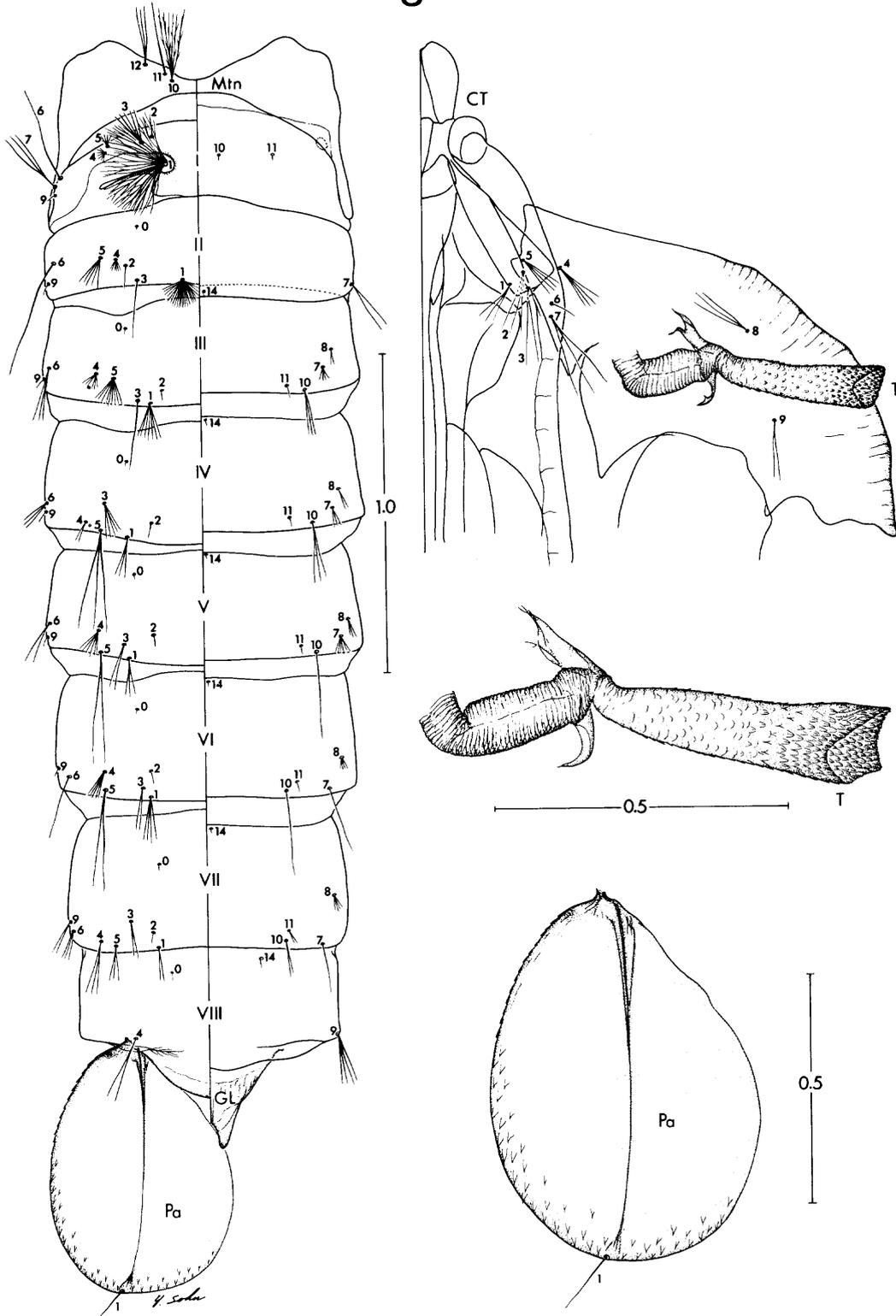
butleri

Fig.20



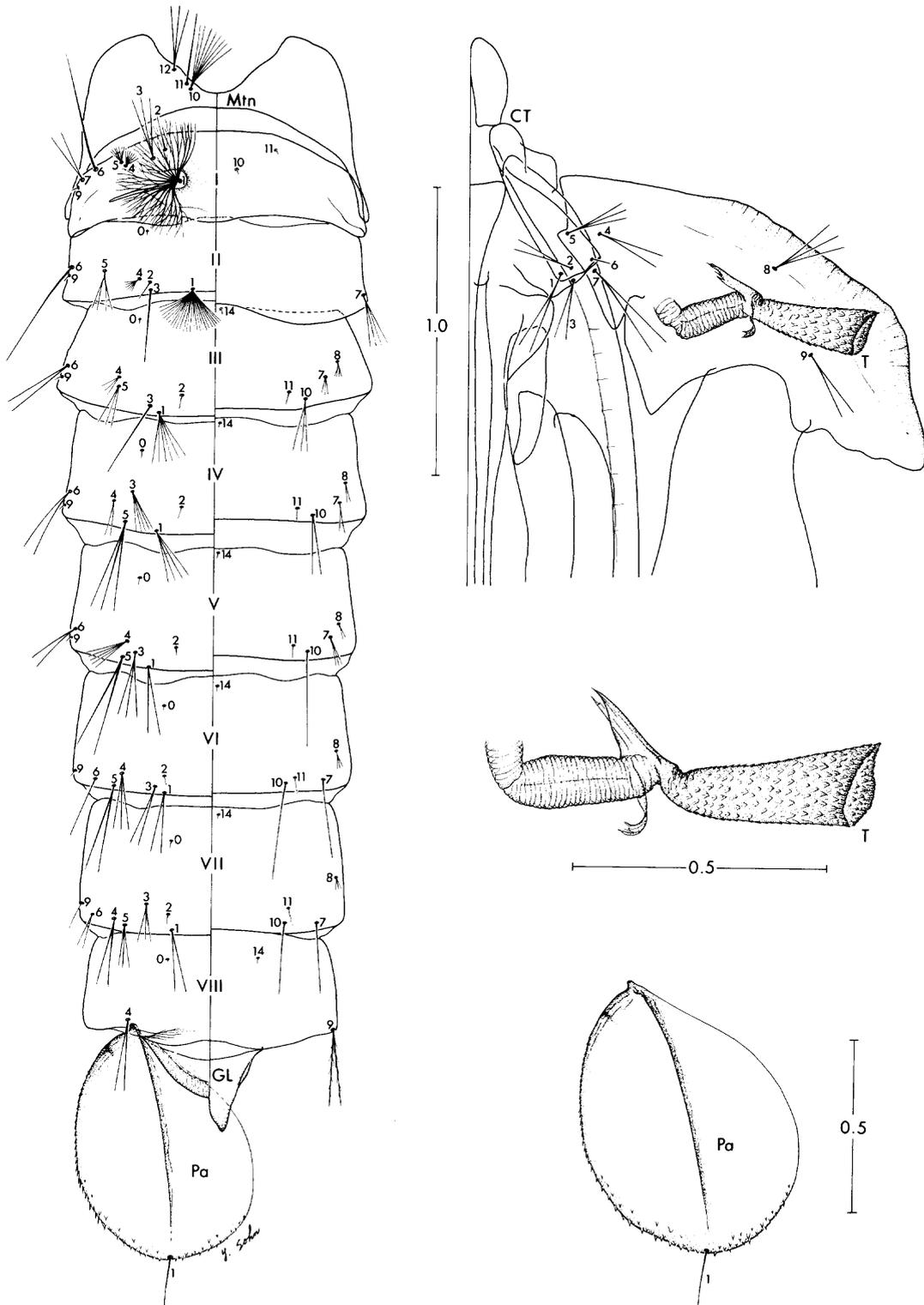
indicus

Fig.21



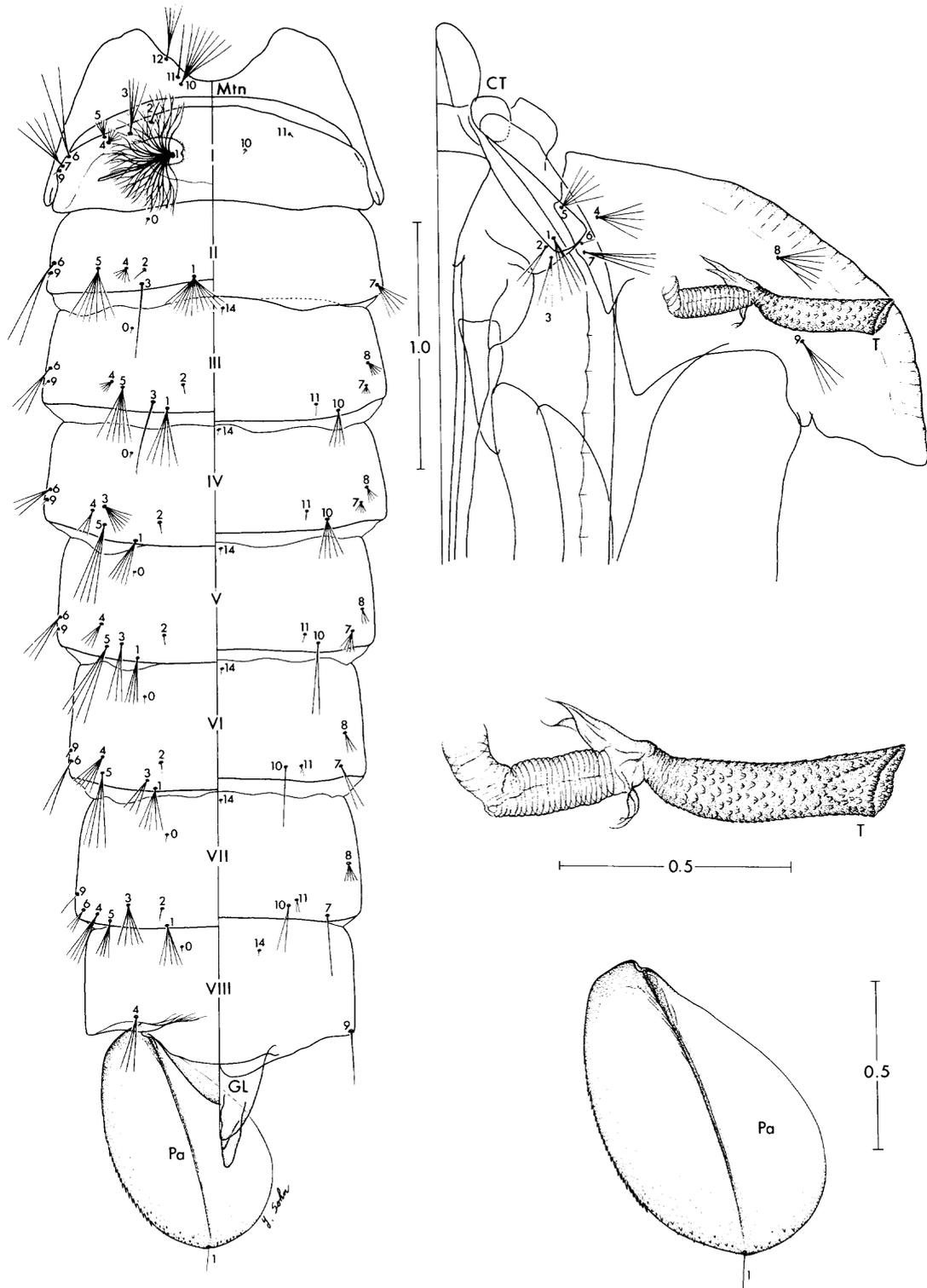
lugubris

Fig.22



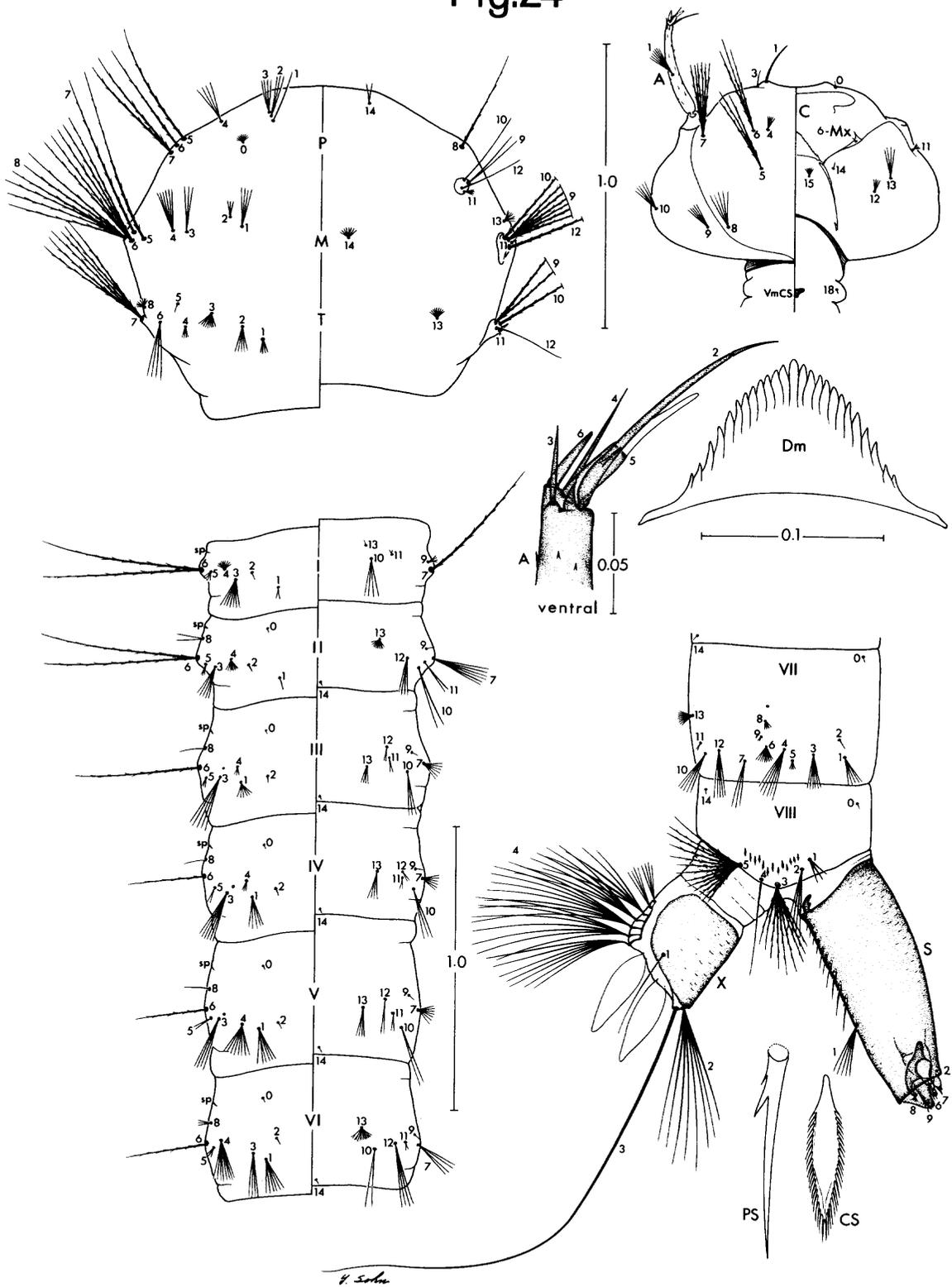
pseudomediofasciatus

Fig.23



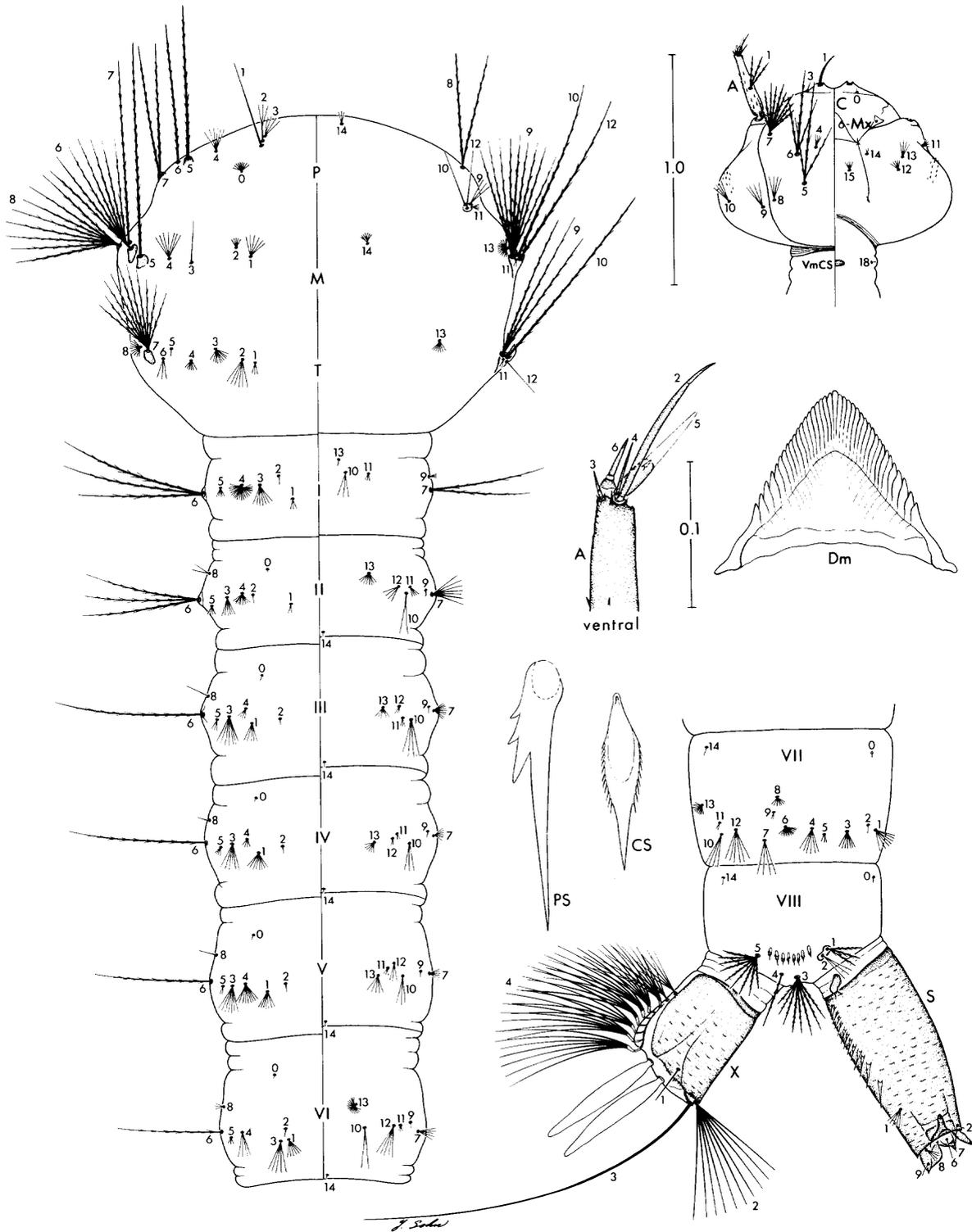
yerburyi

Fig.24



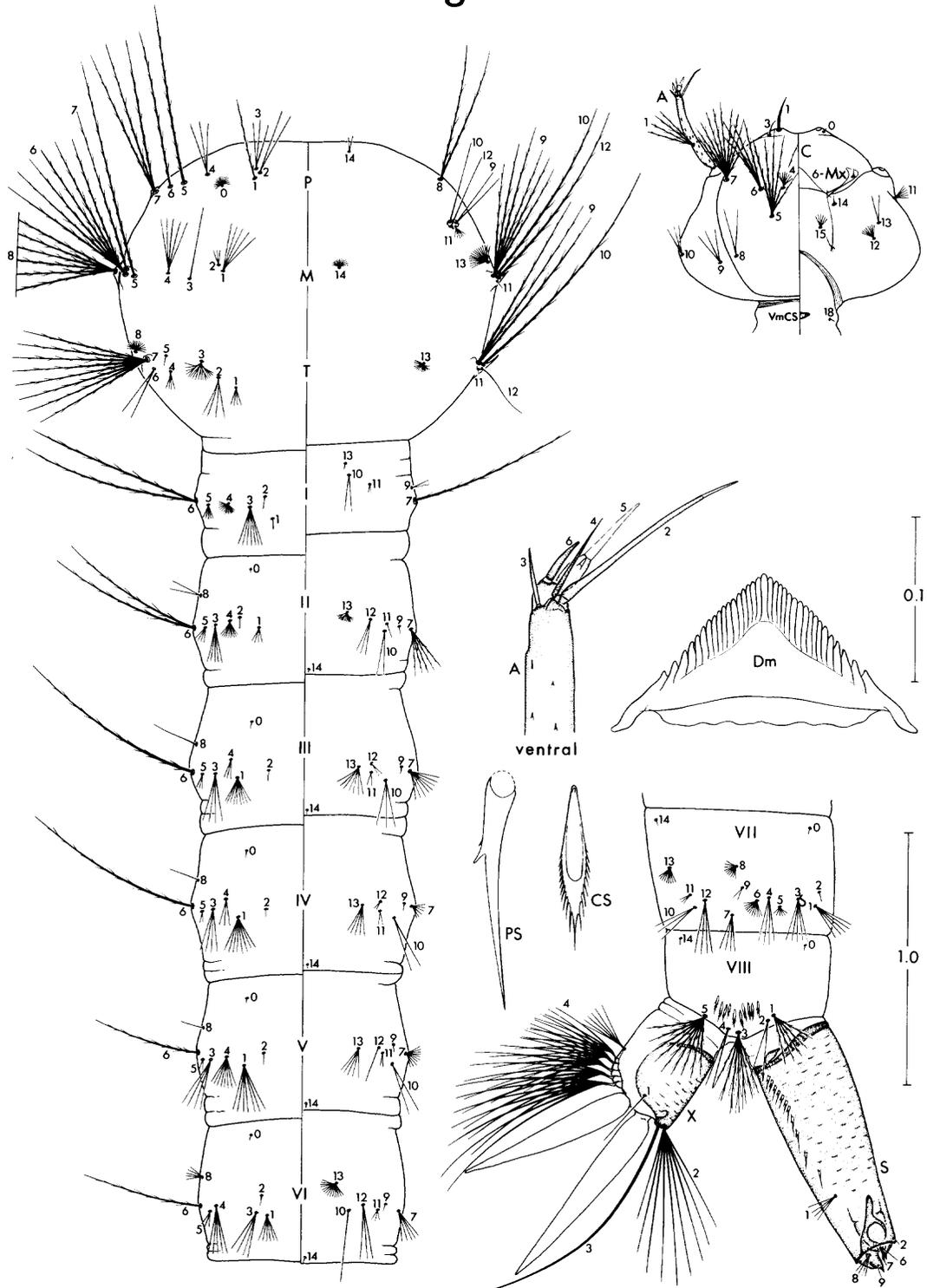
butleri

Fig.25



indicus

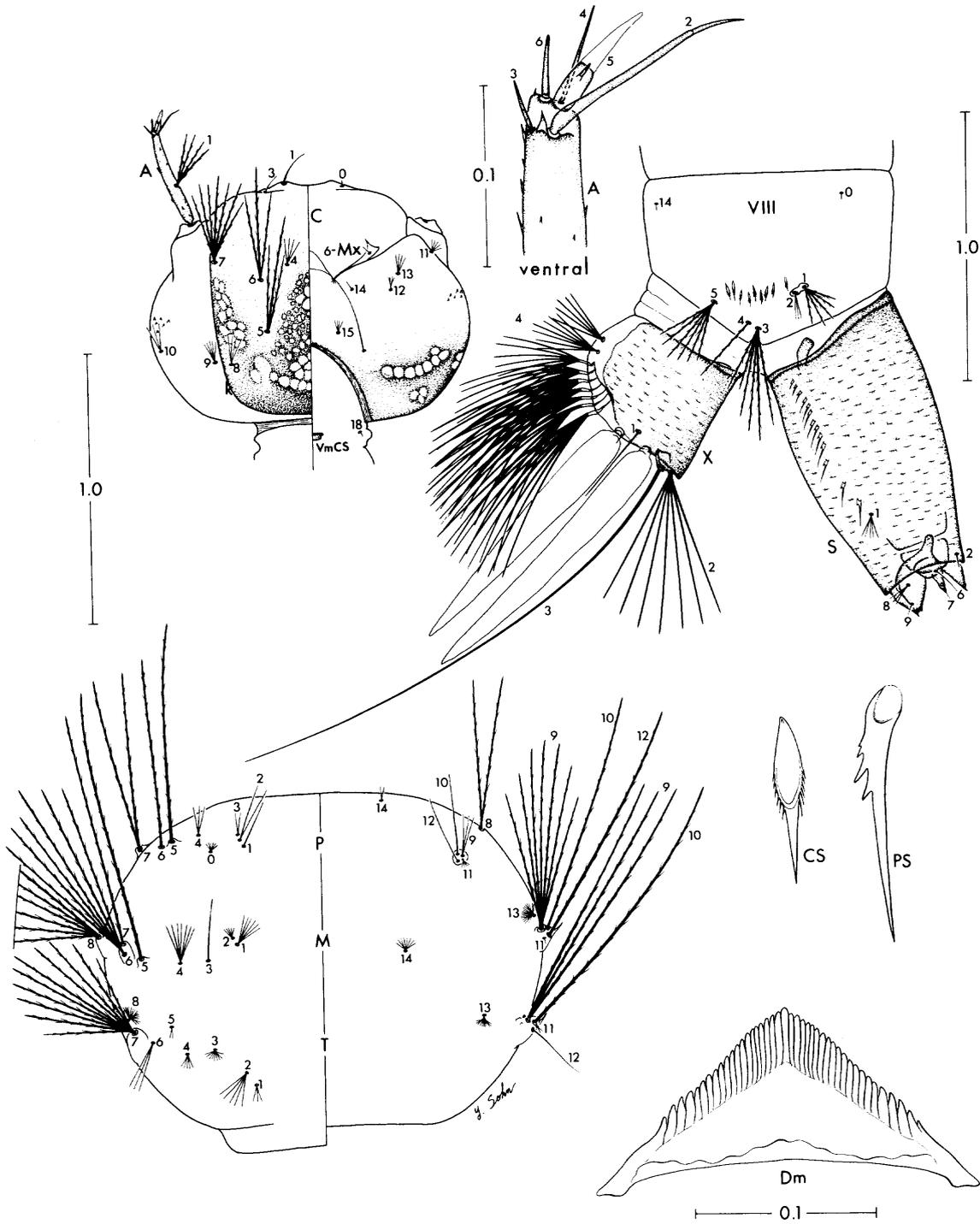
Fig. 26



H. Solov

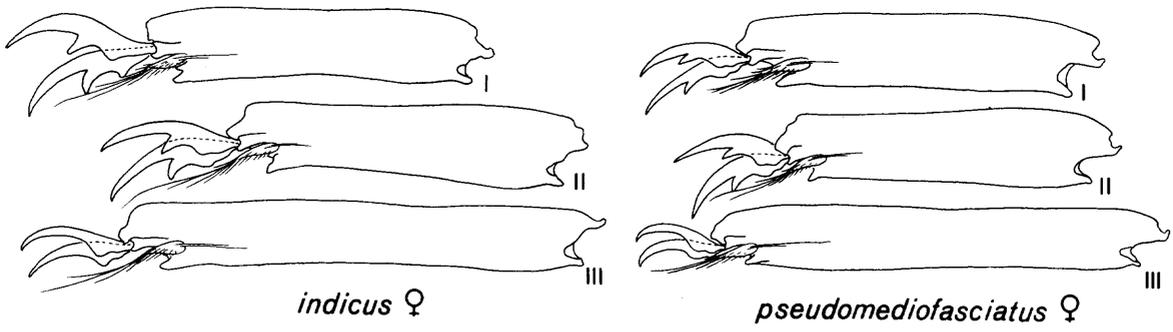
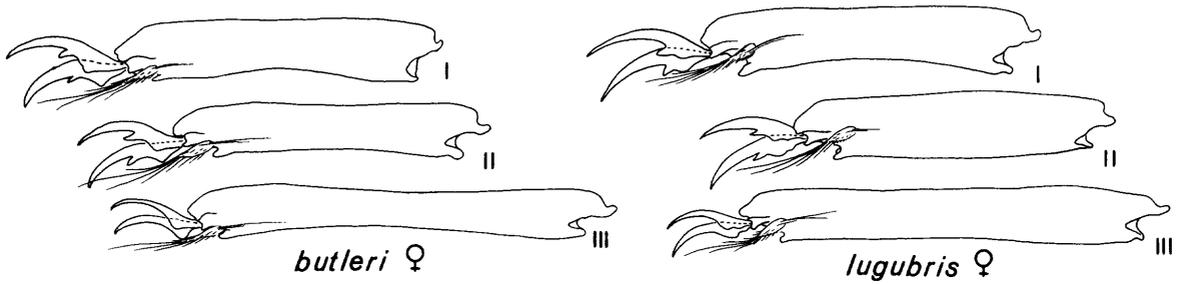
pseudomediofasciatus

Fig.27

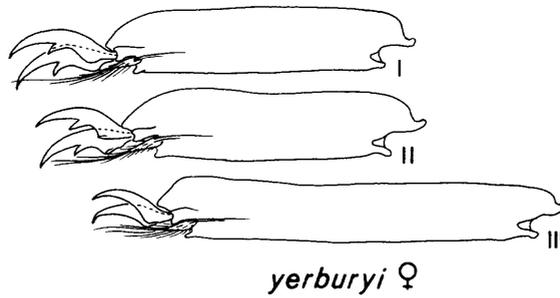
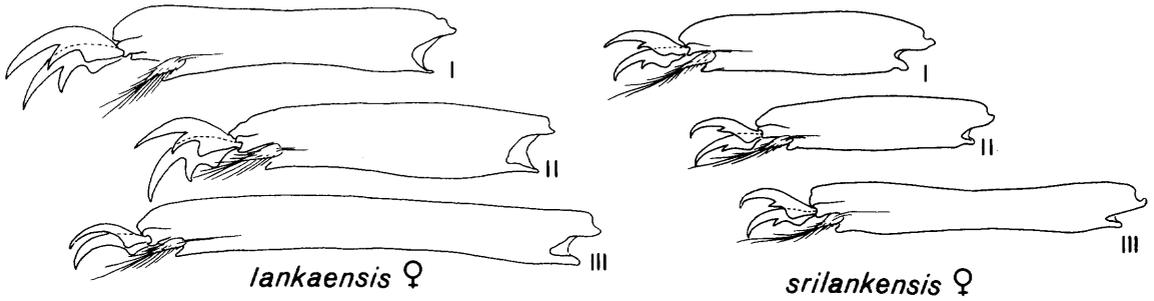


yerburyi

Fig.28

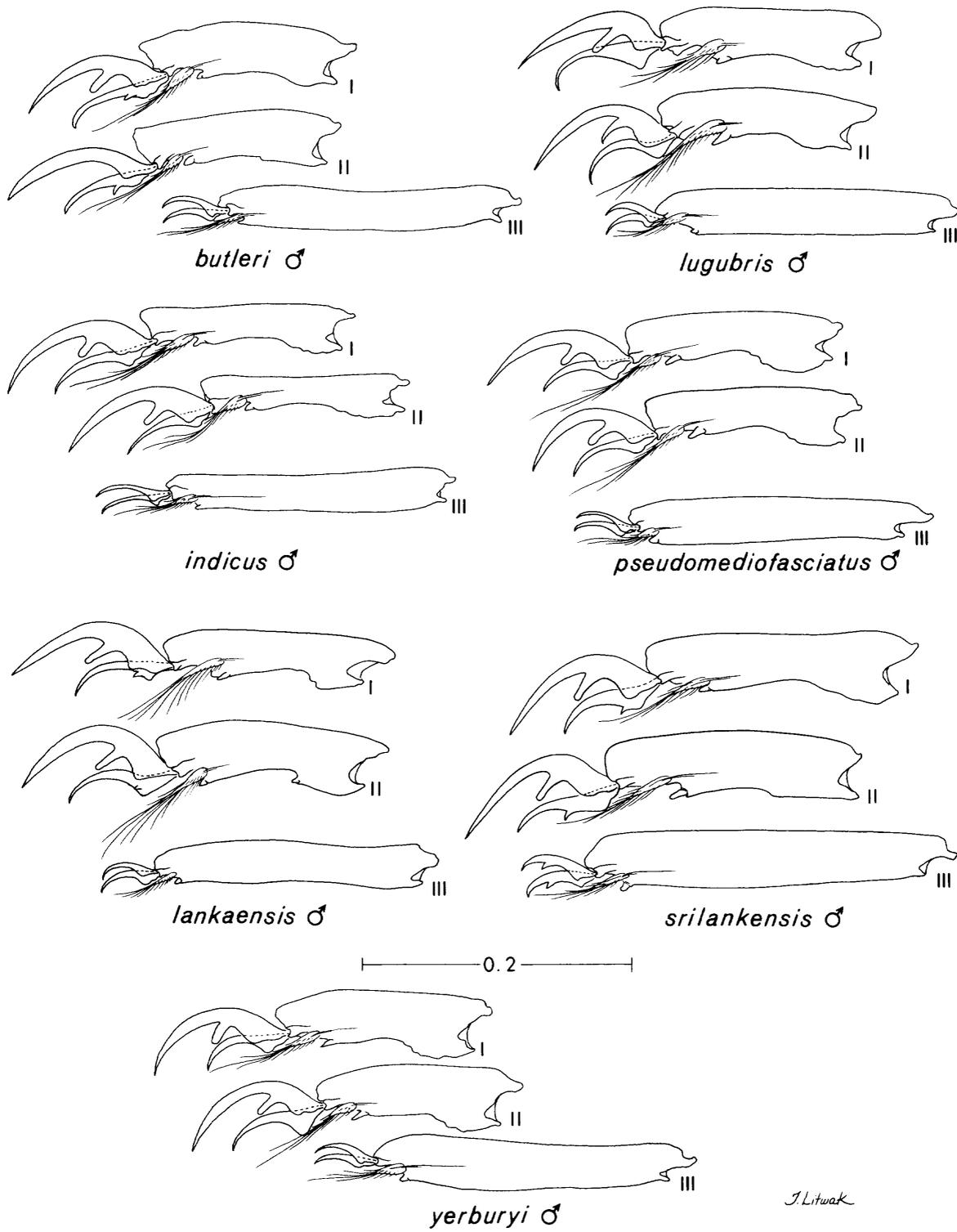


0.2



J. Litwak

Fig.29



J. Litwak

Fig.30

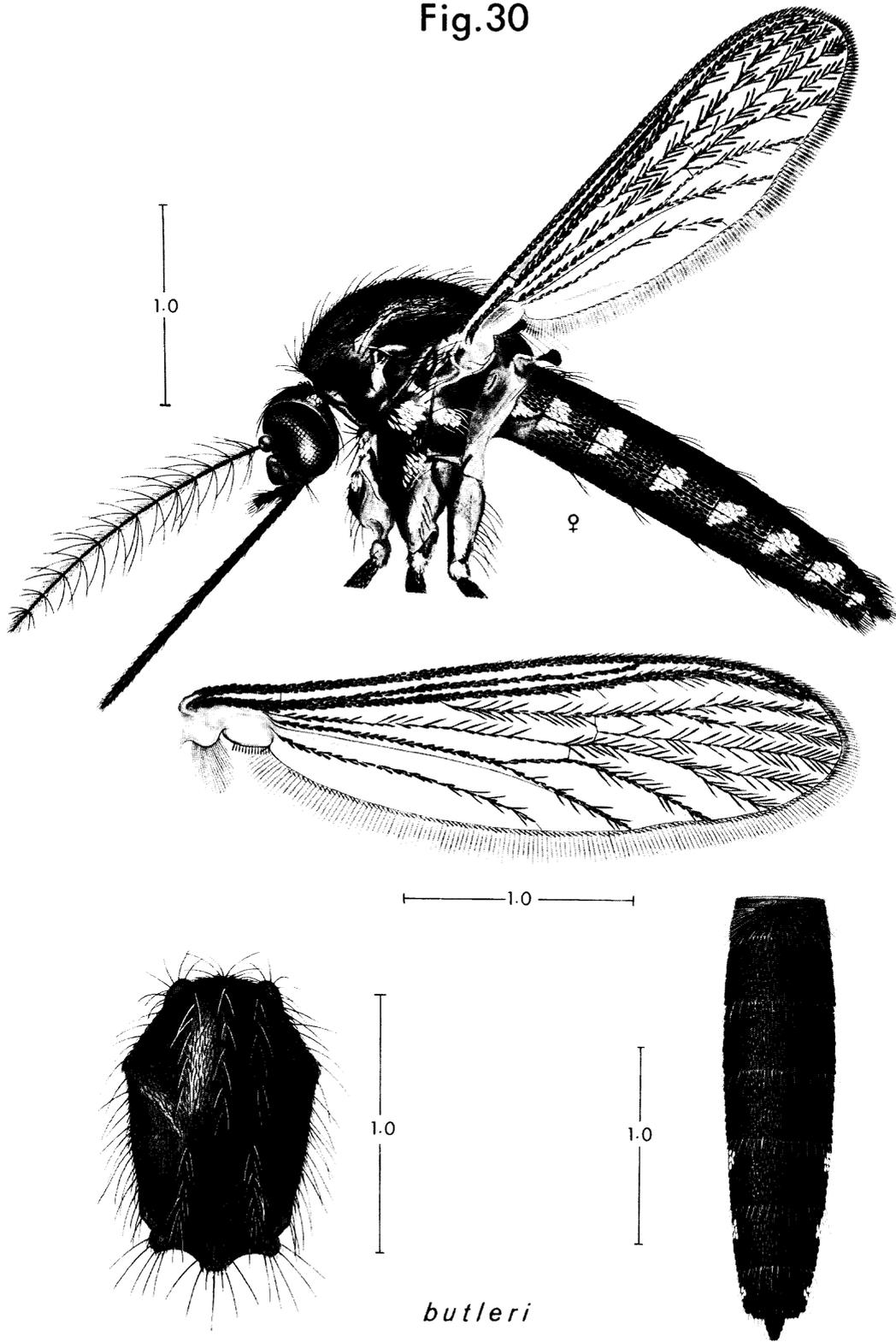
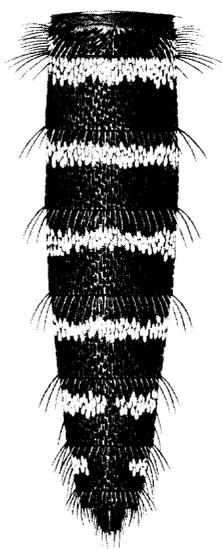
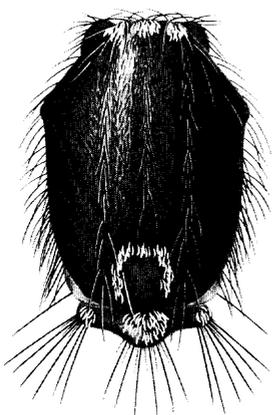
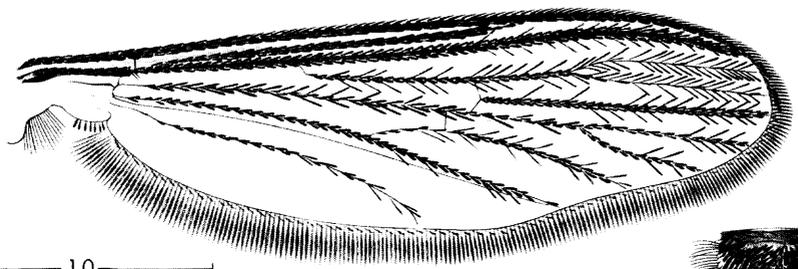
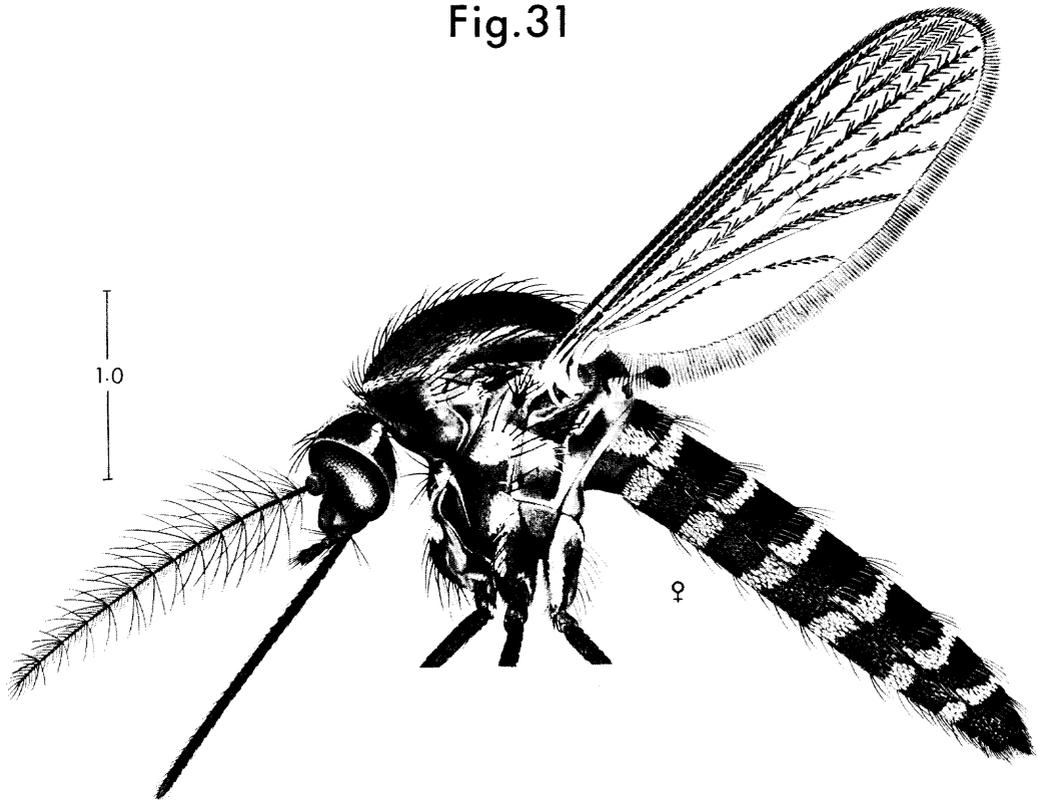


Fig.31



indicus

APPENDICES

Reinert: *Aedes (Verrallina)* of Sri LankaTABLE 1. Record of the branching of the setae on the pupae of *Aedes (Verrallina) butleri* (10 specimens)

Seta	Range	Mode	Seta	Range	Mode	Seta	Range	Mode
Cephalothorax			Abdomen I (Cont.)			Abdomen III (Cont.)		
1	2-5	3	10	1	1	9	1	1
2	1-2	2	11	1-2	1	10	3-6	4
3	1-3	2	Abdomen II			11	1	1
4	1-5	4	0	1	1	14	1	1
5	4-7	5	1	17-27	20	Abdomen IV		
6	1	1	2	1	1	0	1	1
7	3-7	5	3	1	1	1	4-7	5
8	4-7	4	4	4-8	4	2	1	1
9	2-4	3	5	3-7	6	3	4-8	5
Metanotum			6	1	1	4	2-4	2
10	7-13	7	7	3-6	4	5	1-2	2
11	1	1	9	1	1	6	2-4	3
12	3-5	4	Abdomen III			7	2-4	4
Abdomen I			0	1	1	8	2-4	3
1	14-23	20	1	4-10	8	9	1	1
2	1	1	2	1	1	10	3-5	4
3	3-5	4	3	1	1	11	1	1
4	6-9	6	4	4-6	4	14	1	1
5	4-9	4	5	4-7	4	Abdomen V		
6	1	1	6	2-4	3	0	1	1
7	1-4	3	7	4-8	5	1	3-5	4
9	1-2	1	8	3-6	4	2	1	1

TABLE 1 (Continued).

Seta	Range	Mode	Seta	Range	Mode	Seta	Range	Mode
Abdomen V (Cont.)			Abdomen VI (Cont.)			Abdomen VII (Cont.)		
3	3-5	4	4	4-8	5	5	2-4	4
4	4-7	6	5	2-4	2	6	4-8	4
5	1-3	2	6	2-4	3	7	1-3	2
6	2-3	2	7	1-3	2	8	2-4	4
7	4-7	6	8	2-5	3	9	1-2	1
8	2-4	3	9	1	1	10	1-3	2
9	1	1	10	1-2	1	11	1-2	1
10	2-4	2	11	1	1	14	1	1
11	1	1	14	1	1	Abdomen VIII		
14	1	1	Abdomen VII			0	1	1
Abdomen VI			0	1	1	4	3-5	4
0	1	1	1	4-6	5	9	1	1
1	4-6	4	2	1	1	14	1	1
2	1	1	3	4-9	6	Paddle		
3	3-6	4	4	3-6	4	1	1	1

Reinert: *Aedes (Verrallina)* of Sri LankaTABLE 2. Record of the branching of the setae on the pupae of *Aedes (Verrallina) indicus* (10 specimens)

Seta	Range	Mode	Seta	Range	Mode	Seta	Range	Mode
Cephalothorax			Abdomen I (Cont.)			Abdomen III (Cont.)		
1	2-3	2	10	1	1	9	1	1
2	2-3	2	11	1	1	10	1-3	2
3	1-3	2	Abdomen II			11	1-2	1
4	2-5	3	0	1	1	14	1	1
5	3-5	3	1	4-7	6	Abdomen IV		
6	1	1	2	1	1	0	1	1
7	2-4	3	3	1-2	1	1	1-4	2
8	2-5	4	4	3-5	4	2	1	1
9	2-3	2	5	2-5	4	3	3-6	4
Metanotum			6	1	1	4	2-4	2
10	3-9	4	7	2-5	2	5	2-3	2
11	1	1	9	1	1	6	1-3	2
12	2-4	2	Abdomen III			7	2-4	2
Abdomen I			0	1	1	8	2-3	2
1	12-25	20	1	3-4	4	9	1	1
2	1-2	1	2	1	1	10	1-4	2
3	1-4	2	3	1	1	11	1-2	1
4	5-10	6	4	2-5	4	14	1	1
5	2-5	3	5	3-6	4	Abdomen V		
6	1	1	6	1-3	1	0	1	1
7	2-5	3	7	2-4	3	1	1-3	2
9	1	1	8	2-4	3	2	1	1

TABLE 2 (Continued).

Seta	Range	Mode	Seta	Range	Mode	Seta	Range	Mode
Abdomen V (Cont.)			Abdomen VI (Cont.)			Abdomen VII (Cont.)		
3	1-5	2	4	2-5	4	5	2-3	2
4	3-7	4	5	2-3	2	6	2-5	4
5	2-3	2	6	1-3	2	7	1-2	1
6	1-4	2	7	1-2	1	8	2-4	3
7	1-5	3	8	2-5	3	9	1-2	1
8	1-4	3	9	1	1	10	1-2	1
9	1	1	10	1	1	11	1-2	1
10	1-3	1	11	1-3	1	14	1	1
11	1-2	1	14	1	1	Abdomen VIII		
14	1	1	Abdomen VII			0	1	1
Abdomen VI			0	1	1	4	1-4	3
0	1	1	1	1-5	3	9	1-2	2
1	2-4	2	2	1	1	14	1	1
2	1	1	3	2-6	3	Paddle		
3	1-4	2	4	2-3	2	1	1	1

Reinert: *Aedes (Verrallina)* of Sri LankaTABLE 3. Record of the branching of the setae on the pupae of *Aedes (Verrallina) lugubris* (5 specimens)

Seta	Range	Mode	Seta	Range	Mode	Seta	Range	Mode
Cephalothorax			Abdomen I (Cont.)			Abdomen III (Cont.)		
1	3-4	3	10	1	1	9	1	1
2	2-4	3	11	1	1	10	3-5	3
3	2-3	2	Abdomen II			11	1	1
4	3-4	3	0	1	1	14	1	1
5	3-6	4	1	18-37	37	Abdomen IV		
6	1	1	2	1	1	0	1	1
7	2-3	3	3	1	1	1	3-9	4
8	3-5	4	4	5-9	6	2	1	1
9	2-3	2	5	3-7	5	3	4-6	5
Metanotum			6	1	1	4	2-3	3
10	5-12	7	7	2-4	3	5	2-3	2
11	1	1	9	1	1	6	1-3	1
12	2-4	3	Abdomen III			7	2-4	3
Abdomen I			0	1	1	8	2	2
1	17-26	18	1	5-8	5	9	1	1
2	1	1	2	1	1	10	3-4	3
3	2-5	4	3	1	1	11	1	1
4	5-7	7	4	4-7	4	14	1	1
5	3-5	5	5	4-9	6	Abdomen V		
6	1	1	6	2-4	2	0	1	1
7	2-4	2	7	3-6	6	1	3-5	3
9	1-2	1	8	2-4	4	2	1	1

TABLE 3 (Continued).

Seta	Range	Mode	Seta	Range	Mode	Seta	Range	Mode
Abdomen V (Cont.)			Abdomen VI (Cont.)			Abdomen VII (Cont.)		
3	2-4	3	4	4-6	5	5	1-4	2
4	5-7	5	5	2	2	6	2-4	4
5	2	2	6	1-2	1	7	1-2	2
6	2	2	7	1	1	8	3-4	3
7	4-6	4	8	3-5	3	9	1-3	2
8	2-3	2	9	1	1	10	1-2	2
9	1	1	10	1	1	11	1-2	2
10	1	1	11	1	1	14	1-2	1
11	1	1	14	1	1	Abdomen VIII		
14	1	1	Abdomen VII			0	1	1
Abdomen VI			0	1	1	4	2-3	3
0	1	1	1	2-3	3	9	3-6	3
1	3-5	3	2	1	1	14	1	1
2	1	1	3	2-3	3	Paddle		
3	2-3	3	4	2-3	3	1	1-2	1

Reinert: *Aedes (Verrallina)* of Sri LankaTABLE 4. Record of the branching of the setae on the pupae of *Aedes (Verrallina) pseudomediofasciatus* (10 specimens)

Seta	Range	Mode	Seta	Range	Mode	Seta	Range	Mode
Cephalothorax			Abdomen I (Cont.)			Abdomen III (Cont.)		
1	2-3	2	10	1	1	9	1	1
2	1-3	2	11	1	1	10	2-3	3
3	1-2	2	Abdomen II			11	1	1
4	2-3	2	0	1	1	14	1	1
5	2-4	3	1	14-30	23	Abdomen IV		
6	1	1	2	1	1	0	1	1
7	2-3	2	3	1	1	1	2-5	3
8	2-4	3	4	3-7	4	2	1	1
9	1-3	2	5	2-4	3	3	3-5	4
Metanotum			6	1-2	1	4	1-2	2
10	5-12	6	7	1-5	3	5	2-3	2
11	1	1	9	1	1	6	1-3	1
12	2-3	3	Abdomen III			7	1-3	2
Abdomen I			0	1	1	8	1-3	1
1	15-38	28	1	3-6	5	9	1	1
2	1	1	2	1	1	10	2-3	3
3	2-4	2	3	1	1	11	1	1
4	5-9	6	4	1-3	2	14	1	1
5	4-8	5	5	3-6	3	Abdomen V		
6	1	1	6	1-3	1	0	1	1
7	2-3	2	7	2-4	3	1	1-2	1
9	1	1	8	2-4	3	2	1	1

TABLE 4 (Continued).

Seta	Range	Mode	Seta	Range	Mode	Seta	Range	Mode
Abdomen V (Cont.)			Abdomen VI (Cont.)			Abdomen VII (Cont.)		
3	2-3	3	4	1-5	3	5	1-3	1
4	2-5	4	5	1-2	2	6	1-3	2
5	1-2	2	6	1	1	7	1-2	1
6	1-2	1	7	1	1	8	1-3	2
7	1-4	3	8	2-3	2	9	1	1
8	1-3	1	9	1	1	10	1-2	1
9	1	1	10	1-2	1	11	1	1
10	1-2	1	11	1	1	14	1	1
11	1	1	14	1	1	Abdomen VIII		
14	1	1	Abdomen VII			0	1	1
Abdomen VI			0	1	1	4	1-3	2
0	1	1	1	1-2	1	9	1-3	2
1	1-2	1	2	1	1	14	1	1
2	1-2	1	3	2-4	3	Paddle		
3	1-2	2	4	1-2	2	1	1	1

Reinert: *Aedes (Verrallina)* of Sri LankaTABLE 5. Record of the branching of the setae on the pupae of *Aedes (Verrallina) yerburyi* (10 specimens)

Seta	Range	Mode	Seta	Range	Mode	Seta	Range	Mode
Cephalothorax			Abdomen I (Cont.)			Abdomen III (Cont.)		
1	2-5	4	10	1	1	9	1	1
2	2-3	2	11	1	1	10	2-5	3
3	2-3	2	Abdomen II			11	1-2	1
4	3-6	5	0	1	1	14	1	1
5	5-8	5	1	7-22	12	Abdomen IV		
6	1	1	2	1	1	0	1	1
7	3-6	4	3	1-2	1	1	4-8	5
8	4-10	6	4	4-8	4	2	1	1
9	2-6	3	5	5-7	7	3	4-9	6
Metanotum			6	1-3	2	4	2-4	3
10	6-11	7	7	3-7	5	5	2-6	3
11	1	1	9	1	1	6	2-5	4
12	2-6	3	Abdomen III			7	2-5	3
Abdomen I			0	1	1	8	2-4	3
1	17-27	19	1	5-13	8	9	1	1
2	1	1	2	1	1	10	2-6	3
3	3-6	4	3	1	1	11	1-2	1
4	5-11	6	4	3-7	5	14	1	1
5	3-6	5	5	3-7	5	Abdomen V		
6	1-3	2	6	2-6	5	0	1	1
7	3-5	4	7	1-5	4	1	3-6	5
9	1	1	8	4-5	4	2	1	1

TABLE 5 (Continued).

Seta	Range	Mode	Seta	Range	Mode	Seta	Range	Mode
Abdomen V (Cont.)			Abdomen VI (Cont.)			Abdomen VII (Cont.)		
3	3-5	4	4	3-7	5	5	2-5	3
4	3-8	5	5	2-4	4	6	2-5	4
5	2-4	3	6	1-5	2	7	1-3	2
6	2-5	2	7	1-4	2	8	3-5	3
7	3-7	4	8	2-5	4	9	1-2	1
8	2-4	3	9	1	1	10	2-4	2
9	1	1	10	1-3	1	11	1-3	2
10	2-3	2	11	1-3	2	14	1	1
11	1-2	1	14	1	1	Abdomen VIII		
14	1	1	Abdomen VII			0	1	1
Abdomen VI			0	1	1	4	2-4	3
0	1	1	1	2-6	5	9	1-2	1
1	3-7	6	2	1	1	14	1	1
2	1	1	3	4-7	5	Paddle		
3	2-4	3	4	2-5	4	1	1	1

Reinert: *Aedes (Verrallina)* of Sri LankaTABLE 6. Record of the branching of the setae on the larvae of *Aedes (Verrallina) butleri* (10 specimens)

Seta	Range	Mode	Seta	Range	Mode	Seta	Range	Mode
	Antenna			Prothorax (Cont.)			Mesothorax (Cont.)	
1	6-9	7	2	2-3	3	10	1	1
	Head		3	2-4	3	11	1-2	2
0	1	1	4	3-5	4	12	1	1
1	1	1	5	1	1	13	7-17	10
3	1	1	6	1	1	14	5-10	8
4	3-6	4	7	1-3	2		Metathorax	
5	2-4	3	8	1	1	1	2-5	2
6	3-4	3	9	1-2	2	2	4-8	5
7	5-7	6	10	1	1	3	6-10	9
8	3-5	4	11	2-6	4	4	4-6	5
9	3-5	4	12	1	1	5	1	1
10	3-5	4	14	2-3	2	6	3-4	3
11	2-5	2		Mesothorax		7	4-8	8
12	4-5	4	1	2-4	4	8	7-12	9
13	2-4	3	2	2-5	3	9	2	2
14	1	1	3	3	3	10	1	1
15	5-7	5	4	4-7	6	11	2-3	3
18	1	1	5	1	1	12	1	1
6 Mx	1	1	6	3-7	5	13	6-9	6
	Prothorax		7	1	1		Abdomen I	
0	9-15	9	8	4-8	7	1	1-3	2
1	1	1	9	6-8	7	2	1	1

TABLE 6 (Continued).

Seta	Range	Mode	Seta	Range	Mode	Seta	Range	Mode
Abdomen I (Cont.)			Abdomen II (Cont.)			Abdomen IV (Cont.)		
3	4-7	5	12	3-5	3	2	1	1
4	9-18	9	13	7-12	8	3	4-6	6
5	3-4	4	14	1	1	4	2-4	2
6	2-3	2	Abdomen III			5	1-3	2
7	1	1	0	1	1	6	1	1
9	3-5	4	1	4-7	6	7	6-11	6
10	3-4	4	2	1	1	8	1	1
11	1-2	2	3	4-6	4	9	1	1
13	1-2	2	4	2-5	3	10	3-4	3
Abdomen II			5	1-3	2	11	2	2
0	1	1	6	1	1	12	2-3	2
1	1-3	1	7	5-8	6	13	2-4	4
2	1	1	8	1	1	14	1	1
3	4-9	5	9	1	1	Abdomen V		
4	6-12	8	10	2-4	3	0	1	1
5	2-4	3	11	2-3	2	1	4-6	5
6	1-2	2	12	2-3	2	2	1	1
7	4-6	6	13	3-5	4	3	4-8	4
8	2	2	14	1	1	4	7-10	8
9	1	1	Abdomen IV			5	1-3	2
10	1-2	2	0	1	1	6	1	1
11	2	2	1	4-6	4	7	6-10	7

Reinert: *Aedes (Verrallina)* of Sri Lanka

TABLE 6 (Continued).

Seta	Range	Mode	Seta	Range	Mode	Seta	Range	Mode
Abdomen V (Cont.)			Abdomen VI (Cont.)			Abdomen VII (Cont.)		
8	1-2	1	11	2-3	2	14	1	1
9	1	1	12	2-5	4	Abdomen VIII		
10	1-2	2	13	13-20	20	0	1	1
11	2-3	2	14	1	1	1	3-5	3
12	1-3	2	Abdomen VII			2	3-5	4
13	3-5	3	0	1	1	3	5-11	7
14	1	1	1	4-7	5	4	1	1
Abdomen VI			2	1	1	5	9-15	10
0	1	1	3	5-7	7	14	1	1
1	4-7	6	4	4-6	5	Abdomen X		
2	1	1	5	3-6	4	1	1	1
3	4-6	4	6	7-11	10	2	6-8	7
4	4-6	8	7	2-3	2	3	1	1
5	1-4	2	8	3-7	5	Siphon		
6	1	1	9	1-2	2	1	4-7	5
7	4-5	4	10	3-5	4	2	1	1
8	3-5	3	11	1-3	2	6	1	1
9	1	1	12	4-6	5	7	1	1
10	1-4	2	13	6-10	9	8	3-6	5
						9	1	1

TABLE 7. Record of the branching of the setae on the larvae of *Aedes (Verrallina) indicus* (10 specimens)

Seta	Range	Mode	Seta	Range	Mode	Seta	Range	Mode
	Antenna		Prothorax (Cont.)			Mesothorax (Cont.)		
1	2-3	2	2	2-3	3	10	1	1
	Head		3	2-4	4	11	2-3	2
0	1	1	4	4-7	5	12	1	1
1	1	1	5	1	1	13	14-16	18
3	1	1	6	1	1	14	7-10	7
4	2-5	3	7	2	2	Metathorax		
5	3	3	8	2	2	1	2-5	2
6	2-4	3	9	2-5	2	2	3-8	5
7	7-12	8	10	1	1	3	3-12	11
8	2-4	4	11	2-5	5	4	3-6	6
9	3-4	4	12	1	1	5	1	1
10	2-5	4	14	2-4	2	6	2-5	3
11	3-6	6	Mesothorax			7	8-12	10
12	4-9	4	1	3-6	5	8	8-19	11
13	3-5	4	2	2-6	3	9	3-4	3
14	1-2	1	3	1-3	1	10	1	1
15	4-8	4	4	5-10	7	11	2	2
18	1	1	5	1-2	1	12	1	1
6 Mx	1	1	6	4-9	7	13	6-12	10
	Prothorax		7	1	1	Abdomen I		
0	6-12	7	8	6-10	8	1	1-3	1
1	1	1	9	7-12	9	2	1	1

Reinert: *Aedes (Verrallina)* of Sri Lanka

TABLE 7 (Continued).

Seta	Range	Mode	Seta	Range	Mode	Seta	Range	Mode
Abdomen I (Cont.)			Abdomen II (Cont.)			Abdomen IV (Cont.)		
3	6-9	7	12	4-6	4	2	1	1
4	14-21	15	13	8-14	8	3	5-7	5
5	3-5	3	14	1	1	4	2-4	2
6	3-4	3	Abdomen III			5	2-3	3
7	2-3	2	0	1	1	6	1-2	1
9	3-5	4	1	5-10	5	7	7-13	10
10	3-4	4	2	1	1	8	1-2	1
11	2-3	3	3	4-8	5	9	1	1
13	1	1	4	3-5	3	10	3-6	4
Abdomen II			5	2-4	2	11	2-4	3
0	1	1	6	1-2	1	12	2-3	3
1	1-3	2	7	7-15	9	13	4-8	6
2	1	1	8	1	1	14	1	1
3	5-9	6	9	1	1	Abdomen V		
4	6-15	8	10	3-6	5	0	1	1
5	2-4	4	11	2-5	4	1	5-6	6
6	2-4	3	12	2-6	4	2	1	1
7	4-10	6	13	3-7	5	3	5-7	5
8	2	2	14	1	1	4	7-11	8
9	1-2	1	Abdomen IV			5	2-4	2
10	2-6	3	0	1	1	6	1	1
11	2-5	3	1	5-7	5	7	6-15	10

TABLE 7 (Continued).

Seta	Range	Mode	Seta	Range	Mode	Seta	Range	Mode
Abdomen V (Cont.)			Abdomen VI (Cont.)			Abdomen VII (Cont.)		
8	1-2	1	11	2-4	3	14	1	1
9	1	1	12	3-6	4	Abdomen VIII		
10	2-6	3	13	21-28	25	0	1	1
11	2-4	3	14	1	1	1	2-5	3
12	2-4	3	Abdomen VII			2	2-3	2
13	4-7	5	0	1	1	3	6-10	7
14	1	1	1	3-7	7	4	1	1
Abdomen VI			2	1	1	5	7-12	9
0	1	1	3	5-12	9	14	1	1
1	5-8	5	4	2-7	7	Abdomen X		
2	1	1	5	2-5	3	1	1	1
3	5-8	5	6	5-14	7	2	9-11	9
4	4-7	6	7	3-4	3	3	1	1
5	2-3	3	8	2-7	2	Siphon		
6	1	1	9	2-4	3	1	3-5	4
7	4-6	4	10	2-5	3	2	1	1
8	3-7	4	11	2-4	3	6	1-2	1
9	1	1	12	4-7	5	7	1	1
10	1-3	2	13	7-14	7	8	3-5	4
						9	1	1

Reinert: *Aedes (Verrallina)* of Sri LankaTABLE 8. Record of the branching of the setae on the larvae of *Aedes (Verrallina) pseudomediofasciatus* (10 specimens)

Seta	Range	Mode	Seta	Range	Mode	Seta	Range	Mode
	Antenna		Prothorax (Cont.)			Mesothorax (Cont.)		
1	4-6	4	2	2-3	2	10	1	1
	Head		3	2-4	2	11	1	1
0	1	1	4	2-4	3	12	1	1
1	1	1	5	1	1	13	11-23	12
3	1	1	6	1	1	14	11-14	13
4	7-12	8	7	2-3	3	Metathorax		
5	5-9	6	8	1-2	2	1	4-5	4
6	3-6	5	9	2-3	2	2	3-5	4
7	9-17	10	10	1	1	3	10-18	16
8	1-3	2	11	4-6	4	4	3-8	5
9	1-5	3	12	1	1	5	1	1
10	2-5	3	14	2-3	2	6	2	2
11	4-7	4	Mesothorax			7	7-10	8
12	6-8	8	1	2-5	3	8	10-20	18
13	2-4	2	2	1-7	3	9	3	3
14	1-2	1	3	1	1	10	1	1
15	4-6	5	4	4-7	5	11	1	1
18	1	1	5	1	1	12	1	1
6 Mx	1	1	6	5-9	5	13	10-16	13
	Prothorax		7	1	1	Abdomen I		
0	14-26	21	8	6-9	6	1	1-3	2
1	1	1	9	5-10	10	2	1	1

TABLE 8 (Continued).

Seta	Range	Mode	Seta	Range	Mode	Seta	Range	Mode
Abdomen I (Cont.)			Abdomen II (Cont.)			Abdomen IV (Cont.)		
3	5-10	7	13	5-22	11	4	2-3	2
4	17-27	21	14	1	1	5	1-4	2
5	3-6	5	Abdomen III			6	1	1
6	2	2	0	1	1	7	6-11	7
7	1-2	1	1	7-12	9	8	1	1
9	2-5	2	2	1	1	9	1	1
10	2-3	2	3	3-5	4	10	2-3	2
11	1-4	4	4	2-4	3	11	1-3	2
13	1-2	1	5	2-5	2	12	2-3	2
Abdomen II			6	1	1	13	4-7	5
0	1	1	7	6-14	9	14	1	1
1	3-6	4	8	1	1	Abdomen V		
2	1	1	9	1	1	0	1	1
3	4-7	6	10	2-3	2	1	6-9	6
4	6-16	14	11	2-3	2	2	1	1
5	3-8	3	12	2-3	2	3	3-5	3
6	2	2	13	6-9	7	4	6-11	8
7	4-10	5	14	1	1	5	1-4	2
8	2-3	2	Abdomen IV			6	1	1
9	1	1	0	1	1	7	7-12	10
10	1-2	2	1	6-10	8	8	1	1
11	1-4	3	2	1	1	9	1	1
12	2-4	3	3	3-5	4	10	1-2	2

Reinert: *Aedes (Verrallina)* of Sri Lanka

TABLE 8 (Continued).

Seta	Range	Mode	Seta	Range	Mode	Seta	Range	Mode
Abdomen V (Cont.)			Abdomen VI (Cont.)			Abdomen VIII (Cont.)		
11	1-3	2	14	1	1	0	1	1
12	1-2	1	Abdomen VII			1	4-6	5
13	4-6	5	0	1	1	2	2-3	2
14	1	1	1	3-6	4	3	6-9	6
Abdomen VI			2	1	1	4	2	2
0	1	1	3	4-8	5	5	6-10	9
1	4-8	6	4	3-4	4	14	1	1
2	1	1	5	3-7	5	Abdomen X		
3	3-5	4	6	9-13	11	1	1	1
4	4-6	5	7	2-4	3	2	6-10	9
5	2-4	4	8	6-11	11	3	1	1
6	1	1	9	1-2	2	Siphon		
7	3-5	3	10	3-5	3	1	2-5	4
8	3-6	4	11	1-3	2	2	1	1
9	1	1	12	3-5	4	6	1	1
10	1	1	13	5-10	7	7	1	1
11	2-3	3	14	1	1	8	2-4	3
12	2-4	3				9	1	1
13	14-20	20						

TABLE 9. Record of the branching of the setae on the larvae of *Aedes (Verrallina) yerburyi* (10 specimens)

Seta	Range	Mode	Seta	Range	Mode	Seta	Range	Mode
	Antenna		Prothorax (Cont.)			Mesothorax (Cont.)		
1	4-6	4	2	2-4	2	9	6-10	7
	Head		3	2-3	3	10	1	1
0	1	1	4	3-5	3	11	1	1
1	1	1	5	1	1	12	1	1
3	1	1	6	1-2	1	13	14-26	16
4	4-8	5	7	2-3	2	14	8-12	8
5	3	3	8	2	2	Metathorax		
6	2-3	2	9	2-3	2	1	2-8	3
7	7-11	8	10	1	1	2	3-7	4
8	2-4	3	11	3-6	4	3	7-13	8
9	3-7	4	12	1	1	4	3-6	4
10	2-5	2	14	2-3	2	5	1-2	1
11	3-6	4	Mesothorax			6	2-4	3
12	3-5	5	1	3-6	5	7	8-11	9
13	3-5	4	2	3-6	4	8	14-17	14
14	1	1	3	1	1	9	2-3	2
15	3-4	3	4	5-8	6	10	1	1
18	1	1	5	1	1	11	1-2	1
6 Mx	1	1	6	5-8	7	12	1-2	1
	Prothorax		7	1	1	13	9-15	11
0	6-12	12	8	5-8	7	Abdomen I		
1	1-3	2				1	1-4	1

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TABLE 9 (Continued).

Seta	Range	Mode	Seta	Range	Mode	Seta	Range	Mode
Abdomen I (Cont.)			Abdomen II (Cont.)			Abdomen IV (Cont.)		
2	1	1	11	3-6	4	1	5-8	6
3	5-8	6	12	3-6	3	2	1	1
4	9-13	13	13	8-13	13	3	7-10	8
5	4-5	4	14	1	1	4	3-4	3
6	2	2	Abdomen III			5	2-4	4
7	2-3	2	0	1	1	6	1	1
9	2-3	2	1	2-4	3	7	8-10	8
10	4-6	5	2	1	1	8	1-2	1
11	1-3	2	3	6-10	6	9	1	1
13	1	1	4	5-8	5	10	3-8	3
Abdomen II			5	2-3	3	11	2-3	3
0	1	1	6	1-2	2	12	2-4	4
1	1	1	7	6-10	7	13	7-10	7
2	1	1	8	1-2	1	14	1	1
3	4-11	9	9	1	1	Abdomen V		
4	5-8	7	10	2-4	4	0	1	1
5	2-6	3	11	3-4	3	1	4-11	6
6	2	2	12	2-5	3	2	1	1
7	5-9	7	13	5-8	5	3	4-8	5
8	2-3	2	14	1	1	4	5-9	8
9	1	1	Abdomen IV			5	2-3	3
10	2-3	2	0	1	1	6	1	1

TABLE 9 (Continued).

Seta	Range	Mode	Seta	Range	Mode	Seta	Range	Mode
Abdomen V (Cont.)			Abdomen VI (Cont.)			Abdomen VII (Cont.)		
7	5-8	5	11	4-7	4	14	1	1
8	1	1	12	2-5	3	Abdomen VIII		
9	1-2	1	13	17-32	21	0	1	1
10	2-4	3	14	1	1	1	3-6	4
11	3	3	Abdomen VII			2	1-4	2
12	2-3	2	0	1	1	3	5-8	6
13	4-8	8	1	5-8	5	4	1	1
14	1	1	2	1	1	5	6-12	7
Abdomen VI			3	5-7	5	14	1	1
0	1	1	4	3-5	4	Abdomen X		
1	5-11	5	5	3-4	4	1	1	1
2	1	1	6	5-9	5	2	6-10	7
3	3-4	3	7	2-3	3	3	1	1
4	4-6	5	8	4-5	4	Siphon		
5	3-4	3	9	2-4	3	1	4-6	4
6	1	1	10	2-3	3	2	1	1
7	4-7	4	11	3-4	4	6	1	1
8	4-7	5	12	3-5	5	7	1	1
9	1	1	13	7-8	7	8	3-4	3
10	2-5	2				9	1	1

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